HIV and AIDS in South Asia

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An Economic Development Risk

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Contents

Figures

Tables

Boxes

Map

Annex Figures

Annex Tables

Foreword

The South Asia region is characterized by relatively rapid economic growth, averaging about 6 percent a year, and low HIV prevalence—less than 1 percent. Does this mean that AIDS is not a "problem" for South Asia? This book answers this question with an unequivocal "No." The reason is that HIV and AIDS pose a risk to economic and social development in the subcontinent.

First, even if the overall prevalence rate is low, as the chapter by Claeson and Wilson shows, there is high and rising HIV prevalence among vulnerable groups at high risk, such as sex workers and their clients, and injecting drug users and their partners, throughout the region. Without scaling up prevention interventions among those at highest risk, these concentrated epidemics can further escalate. There is already a spread into rural areas in some states of India, and a relative increase among women compared with men in those parts.

Second, the threat of contracting HIV imposes a large burden on the welfare of both HIV-positive and -negative individuals. As the paper by Das and co-authors shows, people's mental health can be affected by the specter of HIV and AIDS in society. When one adds the fact that in many South Asian societies there is a stigma attached with behavior associated with HIV, and that people living with HIV and AIDS and their families (especially widows, as shown in Haacker's chapter) risk being banished by society, it is not surprising that Das and her colleagues find that the welfare cost associated with HIV and AIDS amounts to several percentage points of GDP. Conversely, if an intervention can reduce the risks associated with HIV and AIDS, it has benefits beyond the cost of lives saved: it improves the welfare of those who are at risk and those who fear getting the disease. Thus, the careful and conservative analysis by Friedman of an HIV prevention program in Afghanistan is an understatement of the benefits.

Third, if antiretroviral treatment (ART) is provided by the public sector exclusively in a country like India with around 2.5 million people living with HIV and AIDS, it will become prohibitively expensive to the government. When the costs of secondary treatment regimes are incorporated, the overall costs spin out of control, as the paper by Over demonstrates. One of the challenges is that once introduced as a public-provided and -financed commodity, ART and other treatments are very difficult to cut back or to even charge patients a partial fee for those treatments. As Over notes, government needs to play a role in ensuring quality in both public and private delivery systems. In addition to the epidemiological and welfare risk, therefore, there is a political risk associated with HIV and AIDS.

In 1987, Jonathan Mann defined AIDS as three "distinct yet intertwined" epidemics: the first was the epidemic of HIV infection, the second the epidemic of illness due to AIDS, and the third the "social, cultural, economic, and political reaction to AIDS." This book addresses all three epidemics from the perspective of the risks they impose on societies—even in low-prevalence, fast-growing economies. It should be a wake-up call to policy makers who remain complacent about the HIV and AIDS statistics of their countries. It is also a guide to interventions in these settings—especially those interventions that tackle stigma and discrimination head on. Finally, this book is an inspiration to the millions of people worldwide, including the authors of the chapters, who work tirelessly, using whatever tools they have, to bring an end to this epidemic. Together, we can win the fight against HIV and AIDS.

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Executive Summary

This book offers an original perspective on HIV and AIDS as a development issue in South Asia, a region with a heterogeneous epidemic and estimated national HIV prevalence rates of up to 0.5 percent. The analysis challenges the common perception of HIV and AIDS, which has been shaped to a large extent by analysis of HIV and AIDS in regions with much higher prevalence rates. Three risks to development are associated with HIV and AIDS in the region:

First, the risk of escalation of concentrated epidemics. HIV prevalence rates so far remain low in the South Asia region, although there are areas with concentrated epidemics and high and rapidly increasing HIV prevalence rates among vulnerable groups at high risk. The main risk factors that drive the epidemic are sex work and injecting drug use (IDU), especially where these factors intersect. Therefore, prevention measures targeted at injecting drug use and sex work are crucial, and the financing of effective prevention programs, such as comprehensive harm reduction including clean needle exchange, condom use, and treatment of sexually transmitted infection (STI), are sound economic investments in low-prevalence countries with concentrated epidemics.

Second, the economic welfare costs. The impacts of HIV and AIDS on economic growth in the region appear to be very small. But, the epidemic has a disproportionate impact on key population groups. HIV and AIDS frequently results in and exacerbates poverty, as shown by estimates of the economic impact on households and the ability to cope with stigma and other structural amplifiers. Uneven access to health services within countries is also a matter of concern. Available indicators for access to prevention and treatment are correlated with socioeconomic parameters like gender, educational attainment, and wealth. At the same time, the ability to cope with catastrophic illnesses such as AIDS on the household level is limited for households below or in the vicinity of poverty thresholds. Reflecting infection patterns and the low socioeconomic status of widows, women are particularly vulnerable to the social and economic consequences of HIV and AIDS. In addition to the epidemiological benefits, investments in comprehensive prevention efforts, therefore, contribute to containing poverty.

Third, the fiscal costs of scaling up treatment. Access to treatment in the region is low at present, even when compared to countries with much higher HIV prevalence. The weak capacities of health systems in the region contribute to low access and utilization of treatment services. Looking ahead, the fiscal and other challenges of a comprehensive scaling up of antiretroviral treatment (ART) are substantial, underscoring the crucial role of effective prevention now. There are several implications of the findings regarding access to and the financing of ART, including the medical costs of HIV and AIDS alone that put a substantial proportion of the population at risk of poverty, and the economic constraints that may lead to adherence problems in privately financed ART. The limited ability of many households to pay "catastrophic" health expenses associated with ART, and the negative externalities associated with poor adherence, suggest a large and central role for the public sector in the provision of ART.

HIV—An Economic Development Risk in South Asia

Chapter Overview

The chapters, most of which were commissioned specifically for this volume, can be grouped in three broad themes—the epidemiology of HIV and prevention strategies (chapters 1 and 2), economic and development impacts of HIV and AIDS (chapters 3 and 4), and the implications of HIV and AIDS for the health sector (chapters 5 and 6). Within each theme, one chapter provides a more general discussion of the respective issues in the region (chapters 1, 3, and 5), and one chapter highlights aspects of the respective issue in one particular country (with chapter 2 dealing with HIV in Afghanistan, and chapters 4 and 6 discussing aspects of the impact of or the response to HIV and AIDS in India).

Regarding the broad development themes identified by this book, chapters 1 and 2 highlight the epidemiological risks. Chapter 3 surveys the intersection of HIV and AIDS and key development objectives, and is complemented by chapters 4 and 5. The forward-looking discussion of the challenges of scaling up (chapter 5) is complemented by an analysis of the costs of ART in India (chapter 6) and a cross-country analysis of access to treatment (in chapter 3).

I. The Epidemiology of HIV and Prevention Strategies

David Wilson and Mariam Claeson (Chapter 1—*Dynamics of the HIV Epidemic in South Asia*) review the experience with the global HIV epidemic, and lessons learned regarding key factors in HIV transmission. Against this background, they describe the situation in each country in South Asia and derive policy priorities for HIV prevention.

Wilson and Claeson identify three factors that play a major role in understanding HIV transmission: the rate and pattern of sexual partner change, the presence or absence of male circumcision, and injecting drug use. The limited data available suggest that concurrent sexual partnerships are less common in Asia to date than in many of the worst affected countries, suggesting that the potential for widespread sexual epidemics is also lower. Male circumcision could be a factor in explaining the pattern of HIV prevalence in Asia—no country with high circumcision rates reports an HIV prevalence rate exceeding 0.1 percent. However, Wilson and Claeson argue that injecting drug use—frequently coupled with sex work—may ignite epidemics in contexts where they would otherwise be unlikely; and this applies in particular to parts of South Asia, a region that includes some major centers of global drug production and trafficking.

The overall size of the Asian epidemic thus depends on the prevalence and transmission of HIV within and between these vulnerable groups at high risk and the wider community. In many Asian countries, drug-injecting prisoners constitute a priority group in their own right. Mobility can amplify the problem, putting truckers and their helpers, migrants, and refugees at higher risk, as is the case in, for example, Afghanistan. Cross-border mobility of sex workers also contributes to different exposure risks, as in Nepal.

Based on a discussion of the experience in the different South Asian countries, and with prevention interventions in general, Wilson and Claeson conclude that the future size of South Asia's epidemics will depend on the scope and effectiveness of programs for sex workers and their clients, injecting drug users and their sexual partners, and men having sex with men and their other sexual partners. Experience has shown that prevention programs targeting these vulnerable groups at high risk work, they are relatively inexpensive, and they provide a high return on investment. Early, effective programs actively involving sex workers, injecting drug users, men having sex with men, and the sexual partners of these communities can therefore prevent HIV from becoming more widely established in the general population.

Jed Friedman and Edit V. Velenyi (Chapter 2—*Responding to HIV in Afghanistan*) discuss the state of the HIV epidemic in Afghanistan, featuring a low-prevalence country in the region with an early-stage epidemic and where HIV prevention efforts have only recently taken off. Based on a discussion of the effectiveness of HIV prevention, they present a framework for assessing the cost-effectiveness of an HIV prevention program being implemented in the country.

Friedman and Velenyi find that the number of recorded cases of HIV infection is low at present. UNAIDS estimated that fewer than 1,000 people were infected at the end of 2006. However, there are factors that point at a risk of an escalation in HIV prevalence. Notably, almost all reported HIV cases at present are due to injecting drug use, and HIV prevalence in this group—judging from the experience of other countries—can increase dramatically within short time periods. A factor exacerbating the situation in Afghanistan is the long history of conflict, resulting in widespread poverty, low levels of education, and low capacities of health systems. Notably, there is some evidence that the large number of refugees is contributing to the spread of HIV and AIDS. A 2005 study suggested that a large share of injecting drug users in Afghanistan had been refugees in the Islamic Republic of Iran and started using drugs there, before returning to Afghanistan.

Building on an analysis of the effectiveness of prevention measures, Friedman and Velenyi apply a simple framework for assessing the economic benefits and cost-effectiveness of an HIV prevention program being implemented in Afghanistan that is geared toward scaling up of prevention programs targeting high-risk behaviors, notably injecting drug use and unsafe sex, and involving vulnerable groups at high risk, like IDUs, sex workers and their clients, truckers, and prisoners. One notable aspect of their approach is the application of a randomized framework to describe the effectiveness of the program, reflecting the large uncertainties involved in estimating the effectiveness of interventions based on very weak data. Based on an estimate of lost earnings (a fairly restrictive estimate of the economic costs of HIV, see chapters 3 and 4), the median estimates return a cost-benefit ratio of 3.3, which increases to 4.2 when fiscal savings arising from reduced demand for public health services are taken into account.

II. The Economic and Development Impacts of HIV and AIDS

Markus Haacker (Chapter 3—*Development Impact of HIV and AIDS in South Asia*) discusses the impacts of HIV and AIDS from an economic development perspective. In addition to estimates of the aggregate (average impact), it discusses distributional aspects that arise as the impacts of HIV and AIDS differ across population groups, with implications for key development objectives. Importantly, the course of the epidemic and its impacts are affected by policy choices, and the chapter provides a discussion of the development implications of enhanced prevention efforts and of increased access to treatment.

Haacker finds the impacts of HIV and AIDS in South Asia on the aggregate level of economic activity to be small. For India, the effect on GDP (–0.16 percent) corresponds to a one-off loss of about 1.5 weeks of GDP growth, and the slowdown in population growth implies a slowdown in economic growth equivalent to less than one working day per year in the longer run. While some factors such as adverse impacts on human capital accumulation may exacerbate the negative impacts on growth in the longer run, the growth effects appear to be small overall. However, using a simple model that evaluates the direct welfare costs of increasing mortality, Haacker finds that these welfare costs are more substantial, accounting for 3 percent to 4 percent of GDP in India and Nepal.

Many of the adverse development impacts of HIV and AIDS arise from differential impacts across population groups. Notably, the ability to cope with the financial effects of HIV and AIDS differs strongly across wealth quintiles. For the lowest wealth quintile, Pradhan and others (2006) report savings rates of –23 percent for households affected by HIV and AIDS, as opposed to zero percent for the non-HIV group. In a household study on India, 36.5 percent of people living with HIV and AIDS who were able to retain their employment nevertheless reported an income loss, which averaged about 9 percent. Among those who lost their employment (about 9 percent of the sample of people living with HIV and AIDS), the income loss was severe, at about 66 percent.

Based on household data from India, Haacker finds that the situation of HIV-positive widows is worse than for other people living with HIV and AIDS, probably reflecting the low socioeconomic status of widows in general. The infection pattern whereby many women are infected by husbands who acquire the virus earlier and are more likely to die before their wives, together with the low socioeconomic status of women, means that HIV and AIDS have a disproportionate economic impact on women. In India and Nepal, the number of orphans (here used to mean children who have lost at least one parent) will increase to about 0.4 percent of the young population. By age 17, about 0.9 percent of the young population will have experienced orphanhood owing to HIV and AIDS.

Access to antiretroviral treatment in the region (about 20 percent in India, and less than 10 percent in the other countries) is low in an international context. In many countries in the region, one key factor that appears to limit progress in scaling-up is the low capacity of national health systems.

While the data situation is weak, the available evidence points toward inequities both in the reach of prevention efforts and in access to treatment. HIV awareness is substantially lower for the lower wealth quintiles and, within quintiles, awareness is lower for women and rural households. Data on access to treatment across population groups are not available at present. Access to related forms of health services, such as reproductive health services, indicate inequities in access to health services across socioeconomic groups. To the extent that these inequities also extend to access to antiretroviral treatment, they exacerbate the disproportionate impact of HIV and AIDS on poorer population groups.

Sanghamitra Das, Abhiroop Mukhopadhyay, and Tridip Ray (Chapter 4—*Economic Costs of HIV and AIDS in India*) provide an alternative perspective on estimating the costs of HIV and AIDS. The approach focuses on obtaining a model in which households value consumption, children's schooling, and the state of health, and the costs of HIV and AIDS are measured as a monetary transfer that would compensate a household for the disutility associated with coping with the infection of at least one of its members. HIV and AIDS can affect the household's welfare both generally (with HIV-affected households reporting a lower level of well-being) and through the impact of HIV and AIDS on some well-defined health indicators (such as body mass index) that in turn affect well-being.

Das and others find that the total welfare loss (defined as a compensating income variation) is Rs. 67,601 for a male and Rs. 65,120 for a female. Based on an estimate of 2.5 million people living with HIV and AIDS in India, this loss would add up to about Rs. 167 billion per month, corresponding to about 7 percent of GDP. Thus, the estimates by Das and others are several times higher than any estimates of the direct economic costs (in terms of income lost, costs of treatment, and so forth), and also exceed the estimates of the welfare costs of increased mortality owing to HIV and AIDS (discussed by Haacker, this volume).

However, it is important to note that this measure of welfare or costs is fundamentally different from those used in the other studies. Das and others attempt to estimate the amount required to restore an individual's well-being after the individual is infected by a serious disease that could well (and, according to their estimates, does) exceed the individual's income several times. Other approaches estimate the income losses caused by HIV and AIDS, or the income loss that would be equivalent to the welfare loss associated with an infection.

III. The Burden of HIV and AIDS on the Health Sector

Mead Over (Chapter 5—*The Fiscal Burden of AIDS Treatment on South Asian Health Care Systems*) discusses the fiscal costs and the effectiveness of a comprehensive scaling up of antiretroviral treatment. He points out that health services in most South Asian countries are dominated by private providers, and discusses the implications for scaling-up efforts.

For India, the country with the highest number of people living with HIV in the region, Over finds that the costs of treatment could rise to US$1.8 billion by 2020, corresponding to 1.2 percent of total health expenditures. In light of the small share of public health expenditures in total health spending, the costs of a comprehensive scaling up would correspond to a much higher share (7 percent) of public health expenditures. The number of patients receiving second-line therapy is projected to rise to 0.5 million by 2020, accounting for 20 percent of people receiving ART. However, reflecting higher prices, second-line therapy would account for over one-half (55 percent) of total costs in 2020.

Controlling for the size of the economy, the projected costs of scaling up, at 2 percent of government expenditures, 5.5 percent of total health expenditures, or 20 percent of public health expenditures, are considerably higher for Nepal than for India, reflecting somewhat higher estimates of HIV prevalence and a higher share of public health expenditures in Nepal, but primarily Nepal's lower level of GDP per capita. Another notable finding regards Pakistan, where the costs of treatment are projected to rise to 6.4 percent of public health expenditures, reflecting both a low share of public health expenditures in total health expenditures and a low overall level of health spending.

Analyzing the structure of health care financing in South Asia, Over finds that the share of public financing and of third-party financing in most South Asian countries is low in an international context; that is, most health services are financed out of pocket, without the benefit of health insurance. The dominant role of the private sector could potentially mitigate the fiscal burden of scaling up, to the extent that privately financed health providers could be mobilized in scaling up treatment. However, in light of the small role of private insurance and the costs of treatment, especially regarding a transition to second-line treatment, ART may not be affordable for a large number of households.

The latter point is accentuated by an assessment of the costs of treatment against the income distribution (using India as an example). For a four-person household, the costs of first-line ART would push a household at the 40th percentile of the income distribution down to the poverty line, that is, to a level of consumption at par with the 20th percentile of the income distribution. The costs of second-line treatment would exceed the entire income of a four-person household for more than half of the population.

There are several consequences from these findings regarding access to and the financing of ART. In the absence of public (and free) ART or some form of insurance, the medical costs of HIV infection alone (not to mention the broader costs described in chapters 3 or 4) put a large proportion of the population at risk of poverty. One implication of this is that economic constraints may lead to problems with adherence to treatment in privately financed ART. Further, the limited ability of many households to pay "catastrophic" health expenses associated with ART, and the negative externalities associated with poor adherence, suggest a larger role for the public sector in the provision of ART than is the case for overall public health services. Finally, the major role of the private sector in South Asia gives prominence to the issue of the quality of private vs. public health services, and the chapter concludes by summarizing the limited evidence in this direction.

Indrani Gupta, Mayur Trivedi, and Subodh Kandamuthan (Chapter 6—*Recurrent Costs of India's Free ART Program*) develop a detailed framework for analyzing the recurrent costs of India's Free Antiretroviral Treatment (ART) Program, illustrating the complexities of obtaining accurate estimates of unit costs that could be used in planning a scaling-up program.

India's Free ART Program was launched in 2004, with the objective of initially expanding access to antiretroviral treatment in the high-prevalence states, and with the plan of subsequent expansion to other states. As of March 2006, there were about 39,000 patients receiving ART under the program. The estimates and projections are based on an assumed increase in coverage to 146,000 by 2011, roughly in line with the program's objectives.

Gupta and others primarily distinguish among the costs of antiretroviral (ARV) drugs, treatment of opportunistic infections (OI), diagnostic tests, outpatient services, and inpatient services, providing detailed documentation of the data sources and assumptions used in deriving the cost estimates, and of the types of services rendered at the five participating hospitals. Recurrent costs that cannot be attributed to ART directly (for example, hospital staff that is paid a fixed salary, but only spends part of its time rendering ART services) are assigned to the ART program based on different measures of utilization.

There is some considerable variation in the costs of ART across participating sites, with costs ranging from Rs. 971 to Rs. 1,847 per month, with an average of Rs. 1,287. The most important cost components were ARV drugs (47 percent on average), CD4 kits and reagents (20 percent) and human resources (20 percent). The unit costs of treatment appear to decline substantially with the number of patients (at least in the range between 200 and 800 patients per site) and—for two sites that started early—between year one and year two of participating in the Free ART program.

One important finding regards the out-of-pocket expenses of participating in the Free ART program, based on a survey of patients participating in the ART program. These were estimated at Rs. 911 per month. The largest items were (additional) food (23 percent), transport (17 percent), and drugs for opportunistic infections (12 percent). Thus, even though ART treatment is free, the private costs of accessing treatment and other medical costs amount, on average, to about 70 percent of the costs of ART.

Overall, Gupta and others estimate the recurrent costs of the Free ART Program at Rs. 1,517 million, or US$35 million in 2007 (based on an assumed number of patients of 100,000), and corresponding to about 1.5 percent of the total health and family welfare budget.

PART I

The Epidemiology of HIV and Prevention Strategies

CHAPTER 1

Dynamics of the HIV Epidemic in South Asia

David Wilson and Mariam Claeson

Introduction

After almost three decades, the understanding of the epidemiology of HIV has greatly improved with respect to the global distribution and diversity of HIV, the HIV transmission dynamics in different contexts, and effective prevention responses. The dynamics of the epidemic are increasingly apparent, with sufficient similarities across the continent to speak broadly of an "Asian" epidemic pattern. Within the Asian epidemic, however, there are important variations.

Experience over the last decades has shown that it is critical to ensure that the responses to HIV and AIDS are based on a rigorous and objective analysis of the biobehavioral determinants of HIV transmission, and that they are tailored to address the major drivers of transmission. Often, national and regional responses to HIV and AIDS have been undermined by generic approaches, which do not address the major local drivers of the epidemic in each context. An understanding of both the underlying similarities and the variations of the pattern of HIV across the region is therefore central to effective responses to the epidemic in South Asia.

Alongside an improved understanding of the transmission dynamics, we have learned how important it is to identify and invest in effective, proven HIV interventions, and to monitor their coverage. Crucially, effective approaches must be undertaken on a large scale and reach a majority of those at risk of infection. These principles are particularly important in Asia, where the complexities and disparities within and between countries regarding the spread and the transmission of HIV compel a well-informed epidemiological reading and effective, focused responses.

This chapter takes stock of the improved knowledge of the epidemiology of HIV. It provides an overview of the scale and heterogeneity of the HIV epidemic, drawing some lessons from the global experience and discussing the situation in South Asia in some detail. It reviews the regional transmission patterns and analyzes key factors and underlying determinants that contribute to it. Finally, it summarizes what is known about the status of implementation of effective prevention interventions and programs in countries. Understanding the epidemic and applying the lessons learned about what works have important implications for current priorities and the future direction of the epidemic in South Asia.

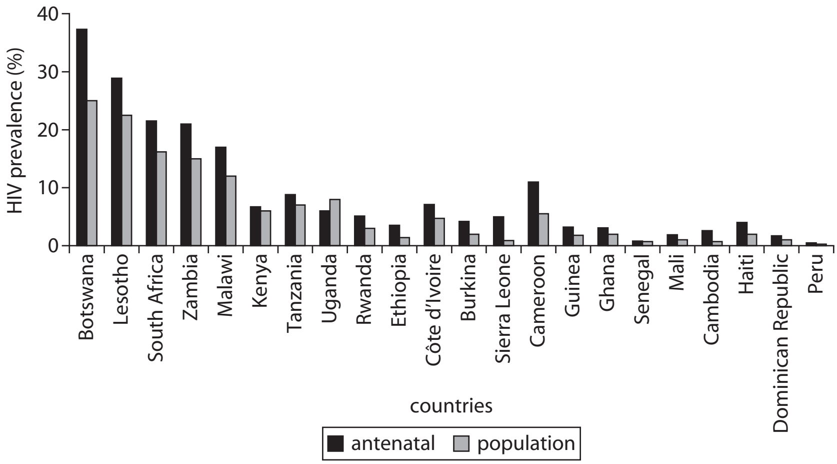
The Global Context

Before discussing the situation in South Asia in more detail, we summarize some lessons learned regarding the global HIV epidemic, to accentuate the specific features of the situation in South Asia and provide some background for a discussion of links between the profile of the epidemic and prevention priorities. In particular, we discuss improvements in estimates of the scale of the HIV epidemic, and key differences in terms of the major HIV drivers and transmission modes across countries.

The Scale and Heterogeneity of the Global HIV Epidemic

Improved surveillance has yielded important results and insights. Most important, estimates of HIV prevalence used to be primarily based on data from antenatal clinics (ANCs). Estimating HIV prevalence for the overall population based on a (possibly small) sample of blood tests from pregnant women poses substantial challenges. In the last five years, these estimates have been complemented by findings from large-scale population health surveys in numerous countries, including Cambodia, Papua New Guinea, Indonesia, and India. These surveys have enabled us to refine and revise previous estimates of HIV prevalence derived from antenatal surveys, and have given us more accurate global HIV prevalence estimates. The results of antenatal and population-based HIV surveillance for the countries that have completed national population-based HIV surveys appear below in figure 1.1.

Figure 1.1 Antenatal and Population-Based Estimates of HIV Prevalence (percent of population, ages 15–49)



Source: UNAIDS, DHS.

As figure 1.1 shows, population-based estimates are lower than antenatal estimates in almost all cases, and significantly lower in many cases. The differences are particularly pronounced in parts of East Africa (notably Rwanda and Ethiopia), much of West Africa (including Sierra Leone, Burkina Faso, and Ghana), and in Asia. Cambodia's population-based HIV prevalence of 0.6 percent is also far lower than its antenatal estimate of 2.6 percent, as are the differences in India, discussed below.

Although the estimates based on ANC surveillance show higher levels than subsequent population-based estimates, the ANC monitoring continues to serve an important purpose in following and analyzing national trends and alerting policy makers to generalized spread of the epidemic in areas of high prevalence. However, improved and expanded biobehavioral surveillance has given us greater insight into the heterogeneity of HIV globally, enabling national governments and development partners to prepare more differentiated national AIDS strategies and programs.

The global HIV epidemic is far more heterogeneous than previously recognized, with strong linkages between the HIV caseload, the major transmission routes, and the optimal prevention interventions and strategies required to curb transmission. A generalized epidemic, as seen in South Africa and Papua New Guinea, is predominantly driven by unsafe sex among the general population. Where HIV is predominantly driven by injecting drug use and unsafe sex among vulnerable groups at highest risk, such as sex workers and their clients, and men having sex with men, a pattern of concentrated epidemics evolve. However, these are not mutually exclusive epidemic patterns, and several other key factors, such as concurrent partnership and male circumcision, contribute to the epidemic dynamics. Although South Asia primarily has concentrated epidemics, injecting drug use (IDU) can jump start a rapidly spreading epidemic within and beyond the IDU community, fueled by sexual transmission among partners, and through a nexus of injecting drug use and commercial sex work, as shown in China and Indonesia. This is a situation to be alert to in several parts of South Asia (Afghanistan, Nepal, northeast India, Pakistan, and Bangladesh).

Key Factors in HIV Transmission

There is increasing evidence that two factors appear to play a major role in understanding HIV transmission globally and the nature of concentrated epidemics specifically: the first factor is acute infection, coupled with concurrent sexual partnerships, and the second is the presence (or absence) of male circumcision. These factors, and the role that injecting drug use plays in the Asian epidemic dynamics, will be discussed here, as they are critical pieces in our understanding of why South Asia is unlikely to face generalized epidemics and why our discussion on the impact of the epidemic and the risk to development in the following chapters are not centered around hypotheses and projections of large-scale generalized epidemics, but instead on the size, spread, and consequences of concentrated epidemics.

The size of an HIV epidemic is significantly influenced by both the **rate and patterns of sexual partner change**. While there is a robust association between the number of sexual partners and HIV infection in many contexts, patterns of partner change may be at least as important (Halperin and Epstein 2004). Growing biological evidence shows that HIV viral load, and thus infectivity, is far higher during acute HIV infection, that is, in the initial weeks after HIV infection (Chao et al. 1994; Quinn et al. 2000). This leads to the important distinction between serial and concurrent sexual patterns (Halperin and Epstein 2004). In serial partnerships, one typically has one ongoing sexual relationship at a time. In concurrent partnerships, one may be in a sexual network with more than one ongoing sexual relationship at a time. Whereas serial partnerships limit exposure to a partner with acute HIV infection (who has higher infectivity), concurrent partnerships expose everybody in an ongoing sexual network to greater risk. Mathematical models suggest that concurrent sexual partnerships may increase HIV transmission tenfold—projections that are firmly supported by growing biological evidence of variability in viral load and infectivity (Morris et al. 1997).

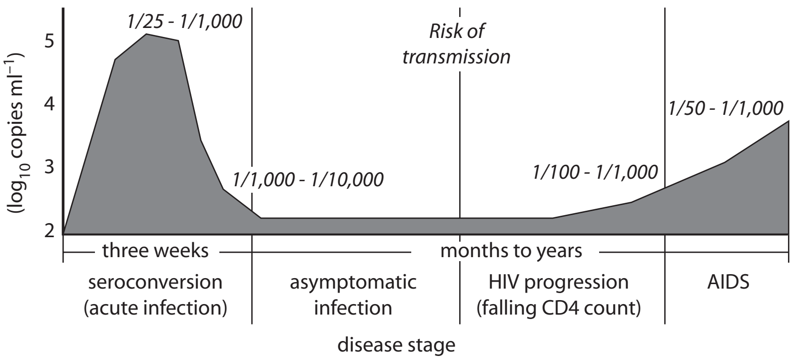
As shown in figure 1.2 below, HIV infectiousness varies over the disease stage, with infectiousness far higher in the first weeks or months after initial seroconversion, during viremia. Infectiousness then declines during asymptomatic infection, before climbing again during HIV illness.

If a person has multiple concurrent sexual partnerships during acute infection, he or she may infect several partners. If they in turn have concurrent sexual partnerships, a cascading chain of infections may rapidly occur. In contrast, serial or sequential sexual partnerships may limit the number of partners who are exposed during acute infection, essentially trapping the virus in a dyadic relationship.

There is some preliminary evidence that concurrent sexual partnerships may be lower in Asia than Africa, suggesting a lower potential for widespread sexual epidemics in Asia. These data are presented in figure 1.3 below.

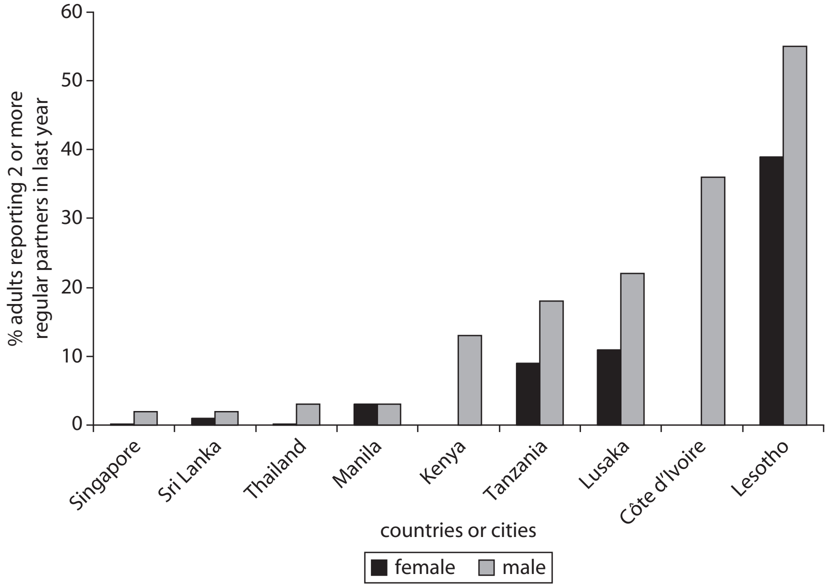
These patterns tentatively suggest that generalized epidemics are unlikely to occur in East Asia. The extent to which we can extrapolate and generalize from these studies to the South Asian epidemic is debatable since more data is needed from South Asian populations on sexual networks and practices, including the frequency of multiple sexual partners. Data from the district level in India, for example from the Bagalkot district of Karnataka state, show a heterogeneous picture, with significant differences in sexual networks and practices between neighboring

Figure 1.2 HIV Infectiousness by Disease Stage



Source: Galvin and Cohen 2004.

Figure 1.3 Percent of Adults Reporting Two or More Regular Partners in Last Year



Source: Halperin and Epstein 2004, adapted from the Lancet.

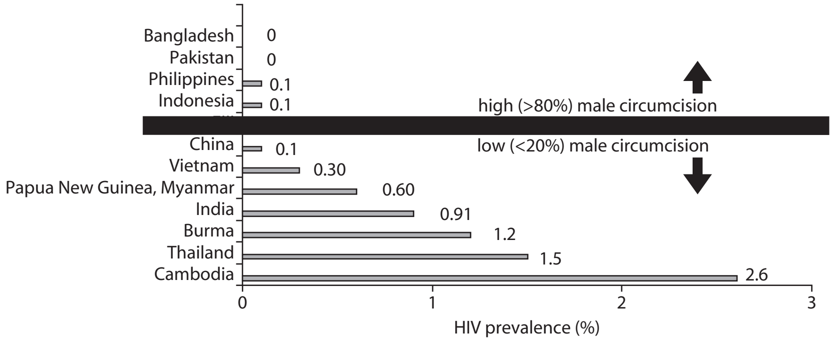
districts and subdistricts influencing HIV prevalence rates (India-Canada Collaborative HIV/AIDS Project (ICHAP) 2004).

An association between HIV and the absence of **male circumcision** has been noted in high HIV prevalence areas since the late 1980s. The following analysis is not intended as an argument for male circumcision as a priority public health intervention in South Asia, but as a heuristic to understand epidemic potential in South Asia. Scientists have noted an association between male circumcision and HIV rates since the 1980s (Bongaarts et al. 1989), including in India (Reynolds et al. 2004). For years, the evidence was considered plausible, but many observers have argued that it is difficult to disentangle other factors, such as religion, culture, sexual behavior, and geography as potential confounding factors. However, the weight of evidence has grown stronger. A meta-analysis of 38 studies from Africa concluded that uncircumcised men were more than twice as likely to have HIV as uncircumcised men (Weiss et al. 1999). A longitudinal study of male sexual partners of HIV-positive women in Rakai, Uganda, found that 40 out of 137 uncircumcised men and 0 out of 50 circumcised men acquired HIV (Grey et al. 2000). Ecological evidence demonstrates an increasingly close geographic association between lower male circumcision rates and higher HIV prevalence rates. A major UNAIDS multicountry comparison of high- and low-prevalence African cities concluded that male circumcision was the major predictor of disparities in HIV levels (Auvert et al. 2001). As figure 1.4 illustrates, no Asian country with a high rate of circumcision has HIV prevalence above 0.1 percent.

The gold standard of public health programs is, of course, a randomized trial. In mid-2005, a randomized trial of male circumcision of 3,035 men in Orange Farm, South Africa, was halted when an interim analysis demonstrated a protective effect so large that it would have been unethical to continue the trial. The analysis showed that male circumcision reduced HIV incidence by 60 percent, from 2.2 percent to 0.77 percent (Auvert et al. 2005). Two other trials in Kenya and Uganda were halted early after they showed a similar protective effect for male circumcision. It should be noted that similar trials have not yet been done in low-HIV-prevalence areas, or in South Asia, which would be of importance to inform prevention policies and program priorities there. In addition, feasibility studies that take into account appropriateness and cultural acceptability factors, and comparative intervention studies, such as studies comparing the effectiveness of the treatment of sexually transmitted infection (STI) to circumcision in low-prevalence settings, are also needed in order to include male circumcision in the list of priority public health interventions for South Asia (appendix table 1).

There are plausible biological explanations for the documented relationship between male circumcision and HIV infection. The intact foreskin has far more Langerhans' target cells than other genital tissue. The

Figure 1.4 Male Circumcision and HIV Prevalence in Asia



Source: UNAIDS 2004.

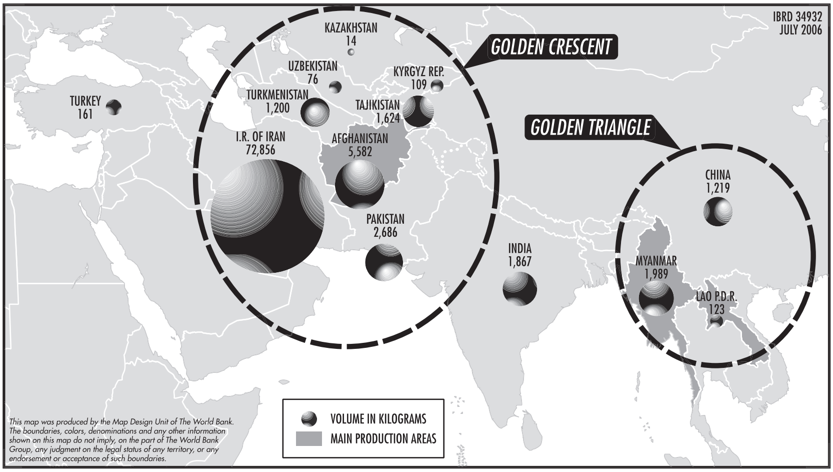
internal foreskin has a soft mucosal surface, unlike the hardened skin-like surface of the external foreskin. Circumcision results in keratinization, or toughening of the glans. An intact foreskin provides the optimal environment for infectious agents (Patterson et al. 2002; Szabo et al. 2000).

The implications of these data for the South Asia region may be summarized as follows. Male circumcision is an important explanatory factor in our understanding of the epidemic potential and the nature of concentrated versus generalized epidemics. Male circumcision is widespread in Pakistan, Bangladesh, and Afghanistan, and uncommon elsewhere in the region. Thus, Pakistan, Bangladesh, and Afghanistan may have a more limited potential for heterosexual HIV epidemics. However, injecting drug use may ignite potential epidemics, particularly if there is a nexus between injecting drug use and sex work. HIV transmission among men having sex with men may also play a proportionately greater role in Pakistan, Bangladesh, and Afghanistan, because of greater transmission efficiency related to anal intercourse, even among circumcised men. Conversely, the absence of extensive male circumcision may increase the relative epidemic potential in other South Asian countries, particularly where it coincides with other behavioral and structural factors, as discussed below.

Injecting drug use may trigger heterosexual HIV transmission in contexts where it may otherwise have been unlikely, including in Pakistan, Bangladesh, and Afghanistan, and amplify it where the potential already exists. A nexus between injecting drug use and sex work may play a particularly important role in igniting and amplifying HIV transmission. The Golden Crescent, which is the nerve center of the global opium trade, straddles South Asia, the Golden Triangle flanks South Asia, and trafficking routes transect the entire region. Four countries in South Asia are directly affected by these production areas—Afghanistan and Pakistan by the Golden Crescent, and India and Bangladesh by the Golden Triangle (United Nations Office on Drugs and Crime (UNODC) 2004). It is clear from map 1.1, showing the two major drug-producing areas in Asia, that HIV risk transcends national borders and requires transregional programming, linking drug-related HIV prevention activities in Afghanistan and parts of Pakistan more closely to Iran, and Central Asia and parts of India and Bangladesh more closely to Myanmar and East Asia.

Drug use contributes to the HIV epidemic mainly through the use of contaminated needles, syringes, and other injecting equipment, and fueled by the practice of sharing among drug users (Ohiri 2006). Injecting drug users are therefore at increased risk, while other drug users also have potential risks from high-risk sexual behavior. The synergy between

Map 1.1 Two Major Drug-Producing Areas that Affect South Asia



Source: UNODC 2004.

injecting drug use and sex work is implicated in the ignition and continuation of most epidemics in Asia.

Globally, there are about 13.2 million injecting drug users, of whom between 1.3 million and 5.3 million live in South and Southeast Asia (UNODC 2006). IDUs tend to be particularly vulnerable to HIV infection because of their highly stigmatized and hidden behavior, and the rapid and efficient way in which HIV spreads through the sharing of contaminated needles, syringes, and other drug use equipment. The demand for drugs is relatively inelastic to price, whereas the demand for a specific type or preparation of a drug (such as the pure form of inhaled heroin) is price elastic. Therefore, a drug addict will continue to demand drugs until he or she is cured of his or her addiction, and when the cost of a particular drug increases (or the drug becomes scarce), the user quickly shifts to other cheaper substitutes, which are often injected.

There is evidence of increased injecting and sharing of injecting equipment in the South Asian region. There is an association between increased injecting risk behavior and (i) length of injecting career (the longer a person has been injecting, the more likely he or she is to share); (ii) frequency of injection (the more frequent, the greater likelihood of sharing and reusing needles); (iii) type of drug used (increased sharing is often observed in heroin users, and some drugs need to be mixed with blood before they are injected (Ohiri 2006)). If such drugs are shared, then the risk of infection increases. The reasons often given for sharing injecting equipment include the unavailability of needles and syringes, due to their high relative cost and inaccessibility; fear of being caught with injecting paraphernalia, which in many places remains illegal; inadequate knowledge about HIV and AIDS, other diseases, and the risk of sharing needles and syringes; the use of shooting galleries and professional injectors, where injecting equipment is shared and reused; and group norms and rituals associated with injecting.

Thus, we have examined some of the factors that explain the dynamics of HIV transmission. To understand HIV transmission in general, and the heterogeneity in South Asia specifically, we need to take into consideration these key biological and behavioral factors and how they interact: infectivity during early HIV infection, concurrent unprotected sexual partnership, sexual networks, including male-to-male sex and commercial sex work, male circumcision, and injecting drug use practices and their socioeconomic determinants. In the next section of this chapter we will examine how these factors play out in the South Asian region.

HIV Transmission Patterns in South Asia

In South Asia, as in the rest of Asia, the epidemic is driven by the prevalence of risky practices, such as injecting drug use and unprotected sex, among vulnerable groups. The overall size of the Asian epidemic depends on the prevalence and transmission of HIV within and between vulnerable groups at high risk; their size; number of sexual or injecting partners; unprotected sex with partners, spouses, and clients; and the extent of preventive measures, such as condom use and clean needle exchange.

In some Asian countries, such as Thailand, Cambodia, and parts of India, the scale and frequency of commercial unprotected sex have been sufficient to ignite sexual epidemics among sex workers, their clients, and a growing number of the clients' sexual partners. In many countries, such as Indonesia and China, injecting drug use triggers epidemics that spread to sex workers, then to their clients and beyond. In many Asian countries, prisoners inject drugs and they constitute a priority group in their own right. Mobility can amplify the problem, putting truckers and their helpers, migrants, and refugees at higher risk, as is the case, for example, in Afghanistan. Cross-border mobility of sex workers also contributes to different exposure risks, as shown by the different HIV prevalence rates among sex workers in Nepal, for example, who cross the border to India to sell sex. As will be discussed in future sections, in the absence of effective prevention responses among vulnerable groups in South Asia, HIV spreads inexorably among vulnerable groups and to their immediate sexual partners.

An understanding of sexual and injecting practices, and their determinants in each context, is central to an informed response that requires both an understanding of vulnerability and risk, and how to engage and reach vulnerable groups with effective responses. Widespread stigma makes it harder to reach vulnerable groups and to implement proven approaches. An informed sociobehavioral understanding and compelling evidence base will better assist countries to develop effective approaches to reaching and working with vulnerable groups.

The South Asian countries demonstrate all these complexities. There is a growing body of biological and behavioral surveillance and research in South Asia, which provides the basis for a better understanding of South Asia's epidemics. India's data-driven response can serve as a model for evidence-based planning and programming (Claeson and Alexander 2008); however, most studies are seldom analyzed and interpreted in an integrated, analytical manner. There is a continuing need for rigorous analysis and synthesis of the major biobehavioral factors and drivers of the epidemic, the structural determinants, and the trends in South Asia's HIV epidemic, reinforced by an equally rigorous review of the evidence base for various interventions, and a review of the scope and reach of existing programs. Such analyses are particularly important at the local level. It is vital to examine the heterogeneity of the epidemic across and within South Asia. The notion of regional or even national epidemics belies the reality of multiple, variegated local epidemics.

By the early 2000s, most countries in South Asia had established some form of sentinel serological surveillance. In addition, India, Nepal, Pakistan, and Bangladesh have initiated second-generation surveillance, and have conducted at least two rounds of behavioral surveillance. Based on these data, South Asia's epidemic is summarized in table 1.1.

South Asia's most severe epidemics are in India and Nepal, where significant transmission occurs through sex work, injecting drug use, and unprotected sex between men. Significant numbers of both men and women have HIV. Both Pakistan and Bangladesh face growing epidemics, primarily among men sharing injecting equipment and men having sex with men. HIV rates remain low among sex workers and there is still an opportunity to avert a heterosexual epidemic. Although there are limited HIV data for Afghanistan, it must act urgently to limit HIV infection in its growing population of injecting drug users. Other countries—Bhutan, the Maldives, and Sri Lanka—have low HIV prevalence rates.

Table 1.1 Overview of HIV Prevalence in South Asia, 2007
(Percent)

Country	*Adult HIV prevalence*	*SW HIV prevalence*	*MSM HIV prevalence*	*IDU HIV prevalence*
India	0.36	2.6–60	2–20	0–50
Nepal	0.49	1.4–16	n.a.	22–68
Pakistan	0	0–0.5	0–2	0.5–23
Bangladesh	0	0–1.7	0–0.8	0–4.9
Afghanistan	0	n.a.	n.a.	0–3
Sri Lanka	0	0–1	0–1	n.a.
Bhutan	0	n.a.	n.a.	n.a.

Source: World Bank 2007.

Table 1.2 Estimated Number of People Living with HIV in South Asia

Country	*Estimated number of people with HIV*
Afghanistan	>1,000
Bangladesh	11,000
Bhutan	>500
India	2,450,000
Maldives	n.a.
Nepal	75,000
Pakistan	80,000
Sri Lanka	5,000

Source: World Bank 2007.

Based on data from UNAIDS, the World Bank estimates that 2 million to 3.5 million people in South Asia may have HIV (table 1.2). This estimate is dominated by India, which has an estimated 2.45 million people living with HIV, with a 95 percent confidence interval of 1.75 million to 3.15 million people living with HIV.

India

India's HIV estimates were revised significantly in July 2007, after the results of the National Family Health Survey, India's first national population-based HIV survey, yielded a lower adjusted HIV prevalence rate (0.41) than previous estimates (0.92) based on antenatal data. The revised and previous estimates are summarized in table 1.3 below.

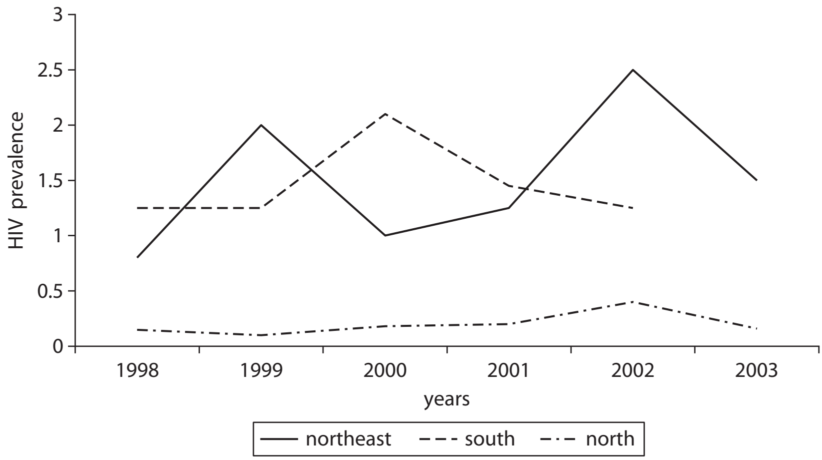
With approximately 30 percent of Asia's population, India has over one-half of the continent's estimated HIV infections. The heterogeneity of

Table 1.3 Revised HIV Estimates in India

	Old official estimate	*New official estimate*
People living with HIV (PLHIV), point estimate	5.7 million	2.45 million
PLHIV, 95% confidence interval		1.75–3.15 Million
Adult number of PLHIV (ages 15–9)	5.2 million	2.3 million
Adult HIV prevalence rate (ages 15–49, percent)	0.92	0.41

Source: NACO 2008.

Figure 1.5 HIV Prevalence in Different Indian Regions



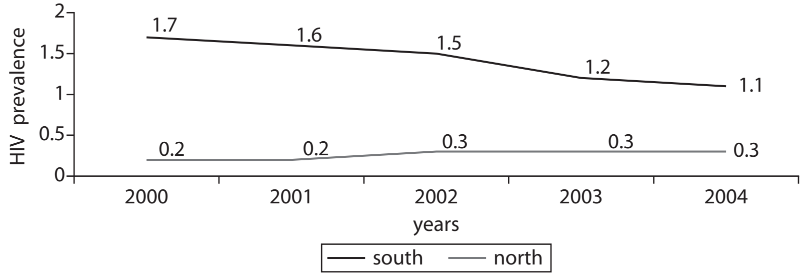
Source: Kumar et al 2005.

the HIV epidemic in India is critically important. Given India's size and complexity, it is best analyzed as a continent, some of whose states are larger than many African countries, and many of whose districts are larger than some African countries. When its size and diversity are acknowledged in this manner, the heterogeneity of its epidemic becomes easier to recognize. HIV in India is concentrated in a few high-prevalence states—in south, west and northeast India—specifically Tamil Nadu, Karnataka, and Andhra Pradesh in south India; Maharashtra and Goa in west India; and Mizoram, Manipur, and Nagaland in northeast India. Data from Kumar et al. (2004) suggest that HIV prevalence in south, west and northeast India is approximately four- to five-fold higher than the rest of India (figure 1.5). Data also suggest that people in south and west India have significantly more sexual partners.

A district-level analysis of India's HIV epidemic is important and revealing (Moses et al. 2006). About 50 key districts in India may have over half of the country's HIV cases. Many of these districts are found in the following three clusters: northern Karnataka and southern Mahasrashta; coastal Andhra Pradesh; and northeastern India. The evidence suggests that India's highly heterogeneous epidemic poses its greatest risk and challenge through locally concentrated epidemics, particularly in south India. There is evidence from mapping studies that in many locations of south India there are substantial pockets of high-risk networks. Most networks involve female sex workers, but there is growing evidence that high-risk networks of men having sex with men (MSM) also contribute significantly to HIV transmission in some contexts. IDU networks are largely concentrated in the northeast states and in urban areas throughout India. The evidence suggests that few places in India are likely to experience a truly "generalized epidemic." While significant numbers of the general population may acquire HIV, it is largely likely to be through exposure to buying and selling sex and injecting drug practices. There is also considerable evidence from Karnataka and elsewhere of a significant rural epidemic, with rural HIV prevalence and per capita numbers of sex workers exceeding urban figures in many cases (Moses et al. 2006). Recent evidence indicates that the incidence of HIV has begun to fall among young antenatal clients ages 15–24 (the first group in which change is expected) in south India (Kumar et al. 2005), while HIV seem to remain overall low and stable in north India (see figure 1.6).

In summary, India's epidemic remains containable. It is ignited by IDU in northeast India and by sex work elsewhere, with MSM contributing significantly in many areas. It requires a highly disaggregated analysis and response—focusing on high-prevalence districts and hotspots. There

Figure 1.6 HIV Trends among Pregnant Women Ages 15–24 in India



Source: Kumar et al 2006.

is evidence of a significant rural epidemic in parts of south India. Encouragingly, HIV appears to be falling in south India. India has made major strides and recorded notable successes in its response to the HIV epidemic, discussed more in subsequent sections. Nationally, the epidemic has slowed and may be stabilizing or falling in south India. In the state with one of the earliest and most severe epidemics in India, Tamil Nadu, several indicators point to encouraging trends, although vulnerability and risk remain a challenge.

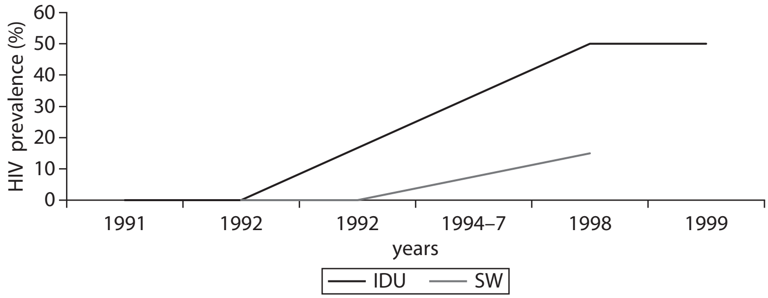
Nepal

Although surveillance in Nepal is limited and has been disrupted by political unrest, the epidemic appears to be more severe than recognized. It is somewhat similar in character to that observed in parts of India and it appears to have the potential for a significant epidemic among vulnerable groups at high risk, especially sex workers and injecting drug users. Injecting drug use is widespread in Nepal and overlaps with commercial sex. Migration to India, in particular to Mumbai, is also associated with increased HIV prevalence. However, with better data at hand, it appears the HIV prevalence rate stabilized between 2004 and 2006. These include surveillance data among populations at higher risk (that is, integrated biological and behavioral surveys among female sex workers (FSW), IDUs, MSM, and migrants, antenatal clinic data, population-based surveys such as the Nepali Demographic and Health Survey, and case reporting (HIV estimations briefing by the National Center for AIDS and STD Control, April 2008). HIV prevalence among adults is estimated at 0.49 percent, with a consistent distribution across regions. Almost 50 percent of all HIV infections are in the area around the Terai Highway and 20 percent are in the far Western hills.

As elsewhere in South Asia, the HIV epidemic in Nepal is likely to continue to be largely driven by injecting drug use and sex work—and in particular, the nexus between the two. As figure 1.7 shows, HIV increased sharply among injecting drug users and sex workers in Kathmandu over a period in the mid- to late 1990s, and these rates seem to have stabilized among FSW and IDUs in recent years (2004–06). HIV prevalence rates in a study of 400 MSM show 6.7 percent HIV prevalence among male sex workers (MSW) and 2.3 percent among non sex workers (MSM) (Family Health International 2007).

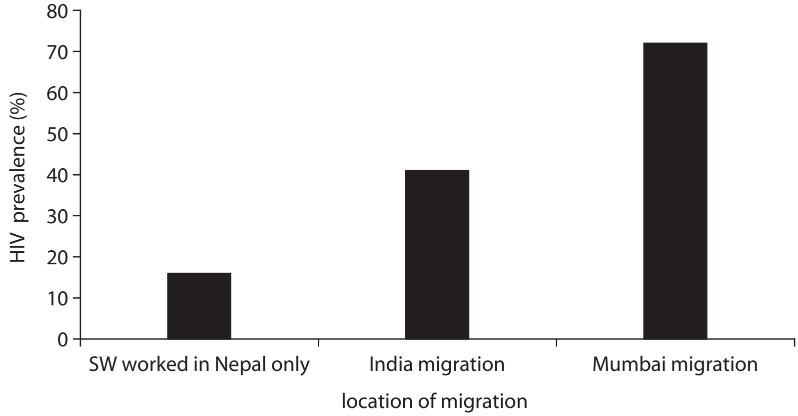
The extent to which migration to India is a risk factor is compellingly illustrated in figure 1.8 below. An estimated 40 percent of Nepal's epidemic is linked to migration to India, and particularly Mumbai.

Figure 1.7 HIV Trends among Injecting Drug Users and Sex Workers in Kathmandu



Source: Author's adaptation from Family Health International 2003.

Figure 1.8 HIV Trends among Sex Workers in Nepal by Migration Status



Source: Author's adaptation from Family Health International 2002.

HIV responses in Nepal have been hindered by instability. Actions to date have mainly been led by NGOs. Nepal requires more urgent assistance to tackle its HIV epidemic than any other country in South Asia.

Pakistan

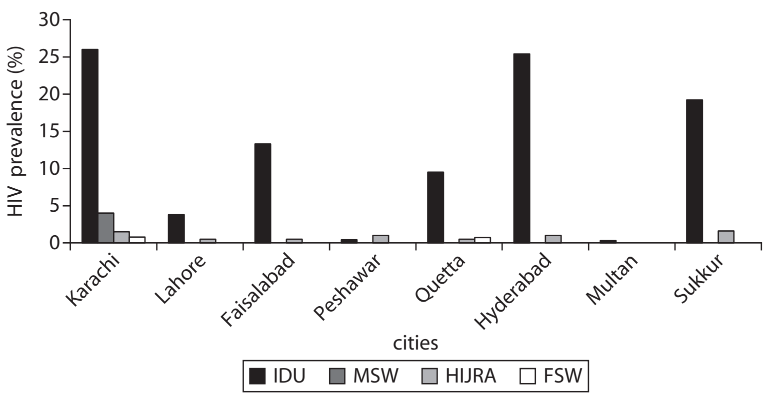
After many years of limited surveillance, Pakistan has recently completed two high-quality biobehavioral survey rounds, which shed significant light on its HIV epidemic Molecular epidemiological evidence suggests that Pakistan's epidemic is at an early stage. There is evidence of a rapid increase in HIV infection among injecting drug users in Karachi and several other cities. Mapping studies have revealed significant populations of injecting drug users in several Pakistani cities (National AIDS Control Program (NACP) 2006). Unless Pakistan rapidly increases the scale and quality of its programs for injecting drug users, it will face a significant epidemic in this population, which also overlaps with sex workers and their clients. Pakistan also has a significant population of male sex workers and hijras, who are showing low but slowly increasing HIV rates. There are also large numbers of female sex workers, whose HIV prevalence is currently low, but who are particularly vulnerable to HIV infection through the nexus between commercial sex and injecting drug use. Figure 1.9 below indicates the major epidemic Pakistan now faces among injecting drug users in Karachi and the growing epidemic among male sex workers.

While high male circumcision rates are clearly playing a major role in dampening sexual transmission in Pakistan, there are powerful lessons from Indonesia, another largely Islamic country with high rates of male circumcision (except in Papua), where HIV rates were low (outside Papua) until the growth of injecting drug use a decade ago changed Indonesia's epidemic trajectory, spreading HIV into commercial sex and fundamentally amplified the epidemic potential. Without effective interventions, similar trends are likely in Pakistan. There is no place whatsoever for complacency.

Bangladesh

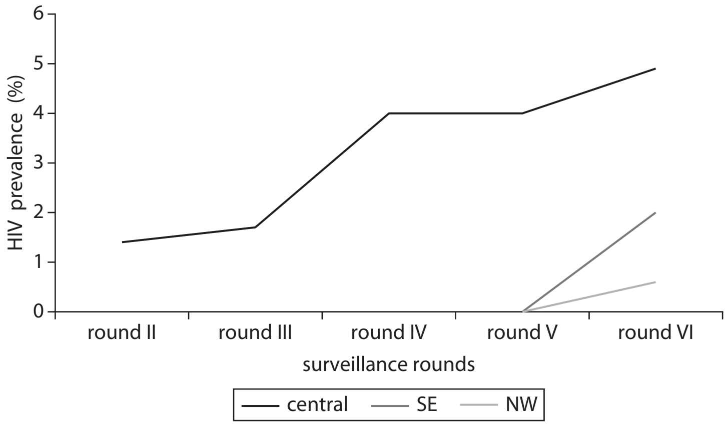
Bangladesh has several rounds of high-quality biobehavioral surveillance. Although Bangladesh's epidemic is broadly comparable to Pakistan's, there

Figure 1.9 HIV Trends among Vulnerable Groups in Pakistan



Source: National AIDS Control Program 2005.

Figure 1.10 HIV Trends among Injecting Drug Users in Bangladesh



Source: National Aids and STD Control Program 2005.

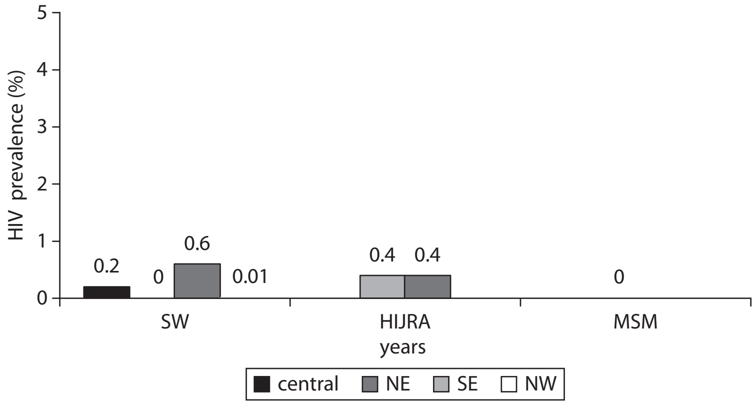
are some important distinctions. First, the scale and vulnerability of sex workers is probably greater. They are larger in number, poorer, and appear to have more clients. Indeed, their numbers of clients are among the highest in Asia. However, Bangladesh also has more established surveillance and interventions than Pakistan. Nonetheless, the scope and coverage of interventions remain inadequate, and Bangladesh faces a potentially major HIV epidemic, particularly among vulnerable groups.

As figure 1.10 below shows, HIV is rising steeply among injecting drug users, particularly in the Central region, which includes the capital, Dhaka (National AIDS and STI (Sexual Transmitted Infections) Program (NASP) 2005). However, the quality of Bangladesh's surveillance also provides important insights into the concentration of HIV in the central region.

HIV prevalence among other groups in Bangladesh is currently low, as shown in figure 1.11. However, rates will not stay low unless the coverage of effective interventions for injecting drug users and sex workers increase significantly. An estimated 62 percent of female injecting drug users are sex workers and they have over 40 clients monthly, many of whom are married (47.8 percent) and live with a regular sex partner (50 percent) in slum areas (50 percent) (NASP 2005).

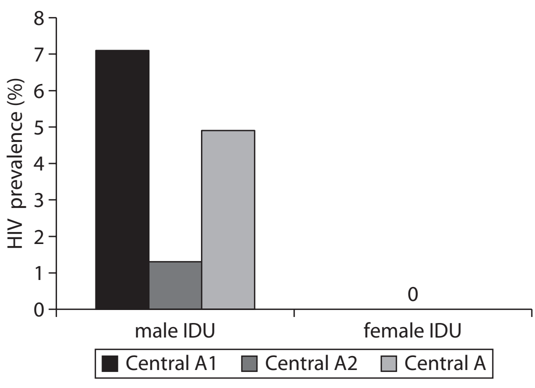
The main reason why HIV is not circulating more widely through commercial sex is because HIV rates among female IDUs are still far lower than among male IDUs—0 percent in the most recent survey, as shown in figure 1.12. If and when this changes, HIV rates may increase

Figure 1.11 HIV Prevalence among Other Groups in Bangladesh



Source: NASCP 2005.

Figure 1.12 HIV Prevalence among Male and Female Injecting Drug Users in Bangladesh



Source: NASCP 2005.

steeply among clients buying sex. Such evidence underscores the pivotal role that effective programs for injecting drug users will play in determining the future of Bangladesh's HIV epidemic.

The record on programmatic effectiveness in preventing the spread of HIV to date is mixed. While large-scale needle and syringe exchange programs (NSEPs) for IDUs in Bangladesh have shown strong associations between participation in those programs and lower rates of sharing equipment and less likelihood of reported STIs, the HIV prevalence rates (2004) have varied from 4 percent (16 out of 403) in one geographic area to zero percent (none out of 605) in another area (The Monitoring the AIDS Pandemic (MAP) Report 2005. More recent data have shown similar differences in behavior change outcomes and HIV prevalence rates among locations. For example, needle and syringe sharing among IDUs has worsened or remained unchanged in the cities sampled for biobehavioral surveys, with the exception of Dhaka, where there has been a reduction in reported sharing from 85 percent to 55 percent. However, Dhaka, with the greatest reduction in needle sharing, is also where HIV has been increasing among IDUs, reaching 10 percent in some pockets, illustrating that it is imperative to scale up comprehensive harm reduction approaches and carefully monitor the quality of the services.

Afghanistan

The HIV epidemic is at an early stage in Afghanistan, concentrated among high-risk groups, mainly IDUs and their partners. Due to the current increase in injecting drug use, there is great potential for the rapid spread of HIV, as has been the case in neighboring countries and in other parts of Asia. A study among IDUs in Kabul city found that 3 percent of the IDUs were already HIV positive (Todd et al. 2006), and the officially reported number of HIV-positive cases in Kabul was 245 (August 2008), most of them men. UNAIDS and WHO, however, estimate that there may be more than 2,000 HIV-positive cases in Afghanistan. Evidence from ex-inmates suggests that injecting drug use takes place in Afghan prisons, a situation also found in many other countries. Long-distance truck drivers and their helpers, and the many abandoned street children are also vulnerable groups, potentially at risk for HIV infection. A social mapping and situation assessment of key populations at high risk of HIV in three cities of Afghanistan showed quite different injecting practices (Chase et al. 2007). Most of the surveyed IDUs had injected within the previous six months, varying from 77 percent to 29 percent in different cities. Most IDUs injected in open spaces in one city, whereas those in another city were more likely to inject at home or in other venues. Most IDUs in the cities injected heroin. Overall, 75 percent of IDUs reported ever having sex with a female, and almost 50 percent had paid a female for sex. Approximately 21 percent of IDUs reported ever having had sex with another male. However, those reporting they had paid for sex with a female or sex with another man within the past six months was uncommon. Condom use appears to be low, with over 80 percent of IDUs who had paid for sex reporting never using a condom during paid sex.

Several other factors contribute to the high risk for the rapid spread of HIV, including war and conflict, migration, displacement, and poverty. Approximately 8 million Afghans spent some time living abroad as refugees, in Pakistan (5 million) and Iran (3 million). Today, about 1 million widows and 1.6 million orphans, 4 million returnees, and 500,000 internally displaced persons reside in Afghanistan, while almost 4 million Afghan refugees still live in Pakistan and Iran. In addition, the literacy rate in the general population is very low (36 percent and lowest among women, at 21 percent), with little awareness about HIV and AIDS and almost no condom use. Unsafe blood transfusion adds to the risk of spreading HIV to the general population, with only 30 percent of transfused blood being tested for HIV.

The current drug situation is amplifying the problem. Production of opium in Afghanistan increased by 59 percent in 2006, and now exceeds 6,000 tons (equivalent to 600 tons of heroin) representing 92 percent of the opium produced in the world. The opium crop is estimated to provide US$2.7 billion to Afghanistan, representing 36 percent of the nondrug or 27 percent of the entire national economy. Although almost all of the opium and heroin produced in the country was previously exported, it is now estimated that 2 percent of the output is consumed locally. A 2005 survey estimated that Afghanistan has almost 1 million drug users, including 200,000 opium users and 19,000 drug injectors, of whom 12,000 inject prescription drugs and 7,000 inject heroin (UNODC 2005). A 2006 survey in Kabul estimated that several categories of drug use had increased by more than 200 percent in 12 months (UNODC 2006). The overwhelming majority of drug users are male, but the proportion of females using prescription drugs is relatively high. As the overall drug problem in Afghanistan continues to receive international attention and most counternarcotics efforts focus largely on supply reduction, there is a risk that opium users will turn to injecting heroin, thus amplifying the risk of HIV transmission.

HIV programs to date have been fragmented and on a small scale. There are a few local and international NGOs and development partners that provide prevention services to high-risk and vulnerable populations, mainly HIV prevention interventions for IDUs, including harm reduction activities. A limited number of interventions have also been designed and launched among sex workers, MSM, truck drivers, and police and prison staff, mainly focusing on HIV and AIDS awareness, condom distribution, and counseling. These activities utilize peer- and community-based education, but are limited in coverage and need to be expanded rapidly. Among the priorities of the national plan are: strengthening communications and advocacy; improving surveillance; providing targeted interventions for people at highest risk; and building program management capacity. To tackle stigma, a HIV code of ethics to protect vulnerable groups that are at high risk has been drafted, which serves as best practice for the region.

Sri Lanka

While Sri Lanka is a low-prevalence country, several conditions contribute to high vulnerability, such as the current conflict, high mobility of the military, internally displaced persons, and separation of spouses due to overseas employment. These structural factors could amplify the problem. Moreover, new economic developments such as the expansion of internal free trade zones, and broad social changes, including the increasing migration of young adults from rural areas to large urban centers, increase their vulnerability and potential exposure to HIV.

Sri Lanka has conducted sentinel serosurveillance surveys on an annual basis among several subpopulations since 1993 (including sexually transmitted disease patients, TB patients, those undergoing pre-employment testing, armed service personnel, antenatal clinic patients, and female sex workers). Available evidence indicates that Sri Lanka continues to have very low prevalence of HIV. Current surveillance estimates (2007) indicate that there are about 5,000 adults and 100 children (under 15 years) infected with HIV, i.e. less than 0.1 percent of adults. Surveillance data on the most at-risk populations (MARPs) are available only for sex workers, who continue to have very low rates of HIV (also below 0.1 percent). While data suggest injecting drug use is uncommon, there are several subpopulations of MSM. However, neither IDU nor MSM have been included in surveillance surveys, and thus little is known of their HIV prevalence, although there are some behavioral data that shed some light on the vulnerability of these population groups at high risk.

The first behavioral surveillance survey (2006–07) collected information related to sex workers, MSM, three-wheeler drivers, drug users, and free trade zone factory workers that indicate relatively high levels of risky behaviors among some of them. Although it is unclear if the drug users surveyed include any IDUs, there are considerable data on sex workers and MSM that note very varied levels of risky behaviors, such as the condom use among sex workers with clients, which varies from 40 percent to 81 percent, and hovers around 10 percent for non-paying clients. Data indicate that MSM have sex with both men and women, and have low to medium condom use with male partners, and even lower use with female partners. One-quarter of MSM and 80 percent of beach boys had had sex with women in the last year. It is difficult to assess levels of risk as the questionnaire asks only about sex in the last 12 months, and thus no distinction can be made regarding frequency of sexual encounters. But given that condom use was less than 50 percent in casual male encounters, and much lower with women, particularly with regular partners, there is a significant potential for HIV transmission. And, while drug users rarely inject drugs, they frequently engage in unprotected sex. The survey indicates lack of knowledge among all groups about how HIV is transmitted.

The survey also includes a sample of free trade zone male and female factory workers, most of them internal migrants. Contrary to common perceptions about risk and vulnerability among these internal migrants, the survey noted very low risky behavior, with only half of men and one-third of women having had sex in the last 12 months, and most did so with their regular partner. Only 5 percent of those sampled had had commercial sex, and 90 percent had used a condom in that event. The risks were higher among three-wheeler drivers. Only 20 percent had had sex with casual partners in the last year, and condom use with casual partners was only 31 percent. Twelve percent had had sex with sex workers in the last year and most (78 percent) reported having used a condom with these partners.

While the national program has focused on the general population and generated awareness about HIV, data show that overall knowledge about how HIV is transmitted remains low. The national AIDS program needs to shift its focus from awareness to behavior change interventions, and from a general population focus to reaching and involving vulnerable groups at highest risk, with continuation of behavior surveillance surveys that can monitor the effectiveness of such programs.

Bhutan

Data in Bhutan are very limited. Serosurveillance has been conducted on a biannual basis since 2000 and large numbers of ANC patients have been tested, as have most in the armed forces. Both of these groups have shown extremely low HIV prevalence rates. UNAIDS estimates that about 500 people out of a total population of 700,000, could have been living with HIV and AIDS at the end of 2005, which would amount to a prevalence of less than 0.1 percent of the population. Information about sex work and IDU is limited, and there is no data on MSM.

While HIV prevalence among the general population is very low, there are some risk factors that indicate the need for a good biobehavioral surveillance system to monitor trends and ensure that prevalence remains low. Data from the general population survey of 2006 noted that multiple concurrent relationships are common. One-fifth of all married people have engaged in extramarital sex in the last year, and 14 percent of unmarried people had sex in the last year. Rates are considerably higher among urban males (43 percent had extramarital sex in the last year, and 42 percent of urban single men had sex in the last year). Condom use with extramarital sex partners is high (76 percent in urban areas, 64 percent rural areas), and ranges from 84 percent for urban males to 44 percent for urban females. Condom use in premarital sex is also high, at 73 percent in both rural and urban areas. Among men having sex with nonregular partners, 15 percent frequent sex workers. While overall this is a small number (4 percent to 5 percent of all men), casual attitudes toward sex in this small, sexually active subgroup of the population, combined with unsafe sex, could eventually lead to small, truncated epidemics.

The open discussion of sexual and reproductive health issues is a positive factor in setting set the stage for effective prevention programs, although Bhutan faces several implementation challenges, such as human resource constraints and lack of local NGOs and community-based organizations (CBOs) that have the necessary experience to work on HIV prevention, targeting interventions and working with those most at risk of HIV.

Maldives

As in the case of Bhutan and Sri Lanka, the Maldives currently has very low HIV prevalence, even among vulnerable groups, such as sex workers and MSM, and the IDU population is very small.

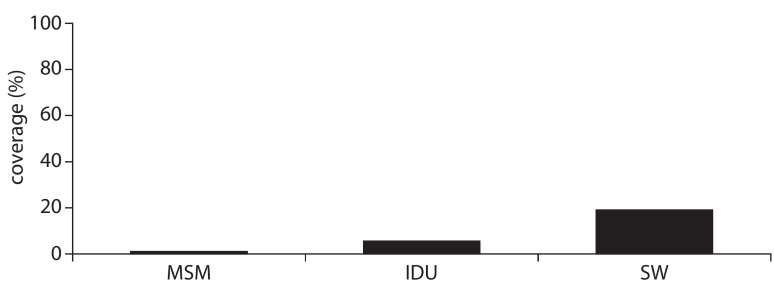
Thus, throughout South Asia, increasing the coverage of high-quality interventions for vulnerable groups at high risk, such as sex workers, men having sex with men, and injecting drug users, is critical to sustain the low prevalence rate. The lessons learned of what works are discussed in the next section.

What Works—Lessons from HIV Prevention Interventions and Programs

It is noteworthy that we have solid evidence for what works in terms of high-impact preventive interventions and how to tackle concentrated epidemics in South Asia through large-scale programs, focusing on vulnerable communities at highest risk. But although we know “what works” and how to deliver effective interventions among vulnerable groups, who are often marginalized in society and widely stigmatized, there are still critical implementation and knowledge gaps in South Asia. Despite encouraging trends in parts of southern India, coverage of prevention interventions remains low overall among vulnerable groups at high risk, as illustrated by figure 1.13, below, which shows coverage of female sex workers below 20 percent, coverage of IDUs below 5 percent, and coverage of MSM below 1 percent in Asia overall (UNAIDS 2005). We lack evidence on coverage of HIV prevention interventions, disaggregated by locality and income, to enable a solid analysis in subsequent chapters of the emerging inequalities and inequities in HIV prevention interventions. Still, emerging global evidence, and monitoring and evaluation of coverage in some areas and among some population groups in South Asia, provide information for trends analysis and lessons of what works for scaling up in South Asia.

Evidence-based preventive intervention packages have been defined, tailored specifically for groups such as youth, women, injecting drug users, men having sex with men, migrants, and employed workers. Appendix table 1 provides examples of such focused, tailored, and targeted

Figure 1.13 Coverage of High-risk Networks with Targeted Interventions in South and Southeast Asia



Source: UNAIDS 2005.

HIV interventions. For each intervention, the core services are listed, along with indicators to monitor access and utilization of these services and behavior change. Some of these indicators are useful proximate determinants for monitoring changes in HIV prevalence, for example condom use and use of clean needles. To expand and evaluate coverage of these services, there are several opportunities through integration of services and convergence of programs in all the countries of the region. These opportunities are also summarized in appendix table 1.

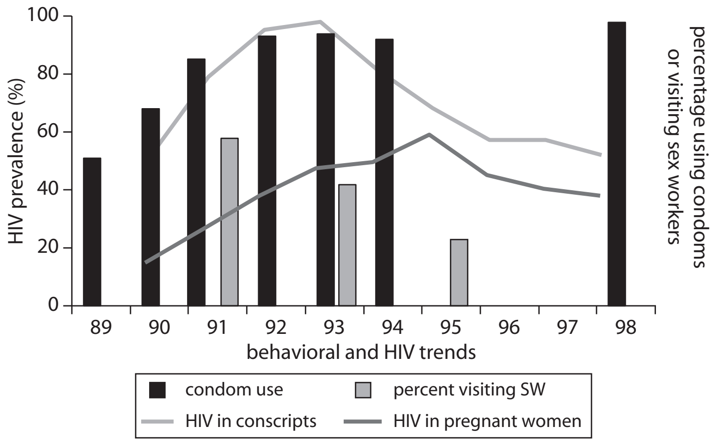
Most national AIDS programs in the countries of the South Asian region have prioritized among these intervention options but coverage is low overall, as highlighted by figure 1.13 above—their challenge now is to scale up coverage to have an impact on HIV prevalence and curb the epidemic. They can learn from some of the successful prevention programs in Asia how to do so.

While there is a strong evidence base for effective interventions, fewer data is available regarding the effectiveness of large-scale programs and the impact of these programs on HIV prevalence. Evidence from India, Thailand, and Cambodia suggests that effective targeted programs can reduce overall transmission. In Thailand, for example, by 1989, HIV prevalence among sex workers reached 44 percent in Chiang Mai brothels and ranged from 1 percent to 5 percent elsewhere. The Thai government prioritized targeted sex work interventions and pursued a 100 percent condom use program in sex establishments. From 1985 to 1993, condom use in commercial sex rose ninefold, from about 12 percent to 95 percent. Over the same period, STDs fell by three-quarters, from over 400,000 to approximately 100,000 (Hanenberg et al. 1994). HIV prevalence declined from 4 percent to 1.9 percent among military recruits and drug users, and antenatal HIV prevalence rates remain under 2 percent (UNDP 2004).

As figures 1.14 and 1.15 below illustrate, both Thailand and Cambodia successfully reduced concentrated HIV epidemics through increased condom use in sex work and decreased consumption of commercial sex.

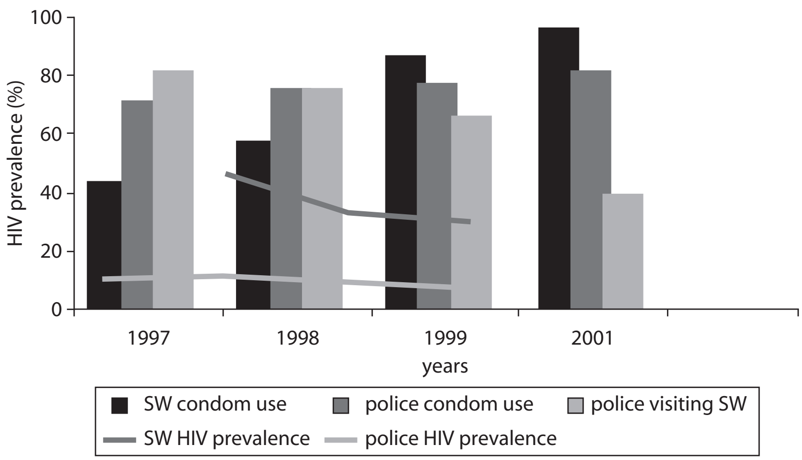
In India, the first site to demonstrate the impact of prevention programs on behavior change and STI and HIV prevalence trends among sex workers and their clients was the Sonagachi Project, West Bengal, as shown in figure 1.16. This project works with about 6,000 sex workers, who serve about half a million clients annually in Sonagachi, Kolkata's major red light district. The project promotes a comprehensive approach to HIV prevention, encompassing contextual reform through improved policing practices, solidarity and community empowerment, improved sexual and reproductive health care, child care, peer education and outreach, and condom promotion. The program, which is cited as a model of social change and community empowerment, has several impressive achievements, including:

Figure 1.14 Reduced HIV Transmission in Thailand



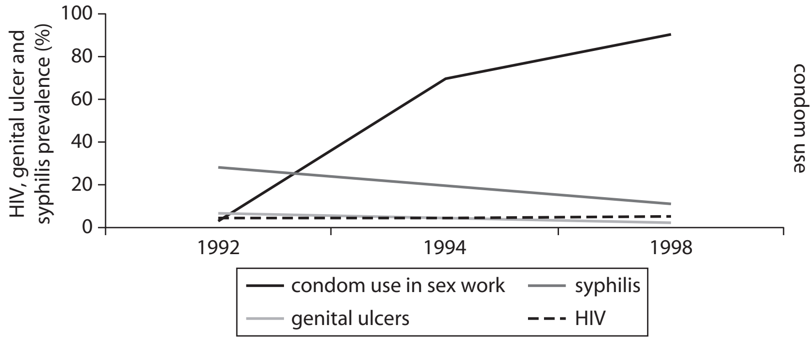
Source: Wilson 2007.

Figure 1.15 Reduced HIV Transmission in Cambodia



Source: Wilson 2007.

Figure 1.16 The Sonagachi Project, West Bengal, India



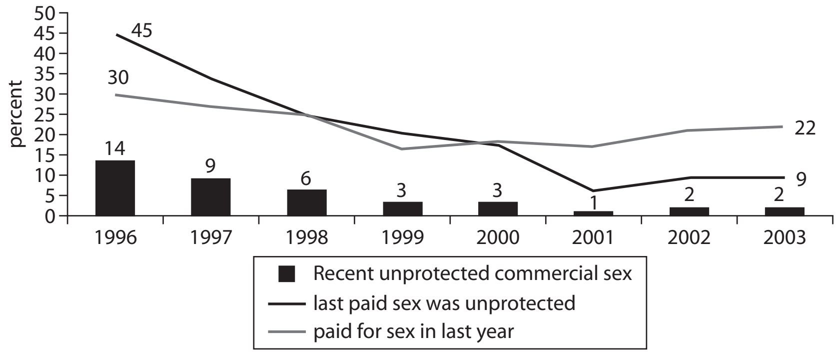
Source: US Bureau of the Census 2008.

- Increasing condom use in sex work from 3 percent in 1992, to 70 percent in 1994, to 90 percent in 1998. By 1998, these rates were far higher than those observed in surrounding red light areas.
- Reducing STI rates among sex workers by over 75 percent: recent syphilis and genital ulcer cases fell from 28 percent and 7 percent, respectively, in 1992, to 11 percent and 2 percent in 1998.
- Stabilizing HIV prevalence among sex workers at 1 percent to 2 percent from 1992 to 1994. However, in 1996, it rose to 11 percent and remained at this level in 1997. HIV rates among sex workers elsewhere in India have generally risen more steeply.

There is also growing evidence that HIV may be declining in south India, particularly in states and districts with well-established HIV prevention responses. The decline is shown in figure 1.5, in the preceding discussion. Changes in unprotected commercial sex attributed to targeted prevention efforts are illustrated by figure 1.17, below, which shows a decline among truck drivers who were buying sex. Similar trends have been observed among sex workers.

These southern India trends in coverage of preventive services and behavior change, measured in Tamil Nadu, influence the overall decline in India since the southern states contribute so much to the overall national HIV burden. Most illuminating are the results of the National Family Health Survey that further validate the effectiveness of existing prevention programs. Table 1.4 below shows some of the selected findings from the India national behavioral surveillance survey, the largest of

Figure 1.17 Reductions in Unprotected Sex in Tamil Nadu, 1996–2003 (percent of respondent truck drivers and helpers)



Source: NACO 2007.

Table 1.4 Changes in Sexual Behavior and Condom Usage

India national behavioral surveillance survey	*2001*	*2006*
Female sex workers		
Condom usage during last nonregular sex	49.3	66.1
Consistent condom usage in nonregular sex during last 12 months	32.4	49.7
General population		
Condom can be procured within 30 minutes	49.6	79.9
Condom usage with paying partners in last sex (Base: All Respondents)	74.5	85.0
Consistent condom usage with paid partners (Base: All Respondents)	57.3	73.9
Condom usage with casual partners in last sex (Base: All Respondents who had casual sex in last 3 months)	32.8	50.4

Source: NACO 2007.

its kind globally, which enables a comparison of risky behaviors between 2001 and 2006.

The successful prevention programs to date have a few characteristics in common: they all invest in evidence-based targeted interventions, such as condom promotion and treatment of sexually transmitted infections; they engage peer educators in outreach; they are well monitored and evaluated, focusing on coverage of effective prevention interventions; and, technical, human, and financial resources are available. There have been similar successful intervention programs among injecting drug users, but on a smaller scale. These HIV prevention programs have also been characterized by outreach and peer education, in addition to comprehensive harm reduction, including clean needle exchange. Evidence from the Stopping HIV/ AIDS through Knowledge and Training Initiative (SHAKTI) in Bangladesh suggests it also works in resource-constrained settings. The project reaches an estimated 5,000 IDUs in Dhaka, providing them with drop-in centers, detoxification services, HIV prevention education and individual counseling, and safe injecting equipment. An evaluation (Tasnim, Hussein, Kelly 2005) showed that HIV prevalence has remained relatively low among IDUs, and risky sexual practices have declined. However, needle sharing soared, climbing from 66 percent in 2002 to 86 percent in 2004. Fieldworkers attribute the increase to police actions against those carrying injecting equipment, which underscores the importance of legal reform to support harm reduction.

The last example highlights one of the challenges to scaling up effective interventions in the region: stigma—especially among the general population toward vulnerable groups engaged in high-risk practices. Lack of awareness and low capacity remain common obstacles to scaling up. Box 1.1, below summarizes some of the principles for scaling up in South Asia, drawing from implementation lessons learned on how to tackle the common constraints across the region. Large-scale programs with high coverage interventions that reflect these principles can achieve at least three critical things. Specifically, they can greatly reduce the size of South Asia's HIV epidemic; prevent HIV from becoming widely established in the general population; and markedly reduce AIDS treatment and other costs, providing a high return on investment.

Conclusions: Prevention Priorities for South Asia

As shown in the preceding sections, the future size of South Asia's epidemics will depend on the scope and effectiveness of programs for sex workers and their clients, injecting drug users and their sexual partners, and men having sex with men and their other sexual partners. The effectiveness of efforts to address the underlying socioeconomic determinants of the epidemic, and to reduce the stigma and discrimination toward people living with HIV, will also be critical to scaling up and sustaining the response.

South Asia's epidemic is highly preventable. Programs for sex workers, injecting drug users, and men having sex with men, work to a large extent. We do know what to do and how to do it. Achieving high coverage is the

Box 1.1

Key Principles and Policy Implications for HIV Prevention in South Asia

- Understanding the drivers of the HIV epidemics in each country. The major drivers of HIV transmission in South Asia are clearly delineated—the challenge is to ensure that they are vigorously addressed.
- Recognizing that transmission is primarily among vulnerable groups at high risk and having the determination to protect vulnerable groups through interventions and policy reforms.
- Ensuring funding for prevention among vulnerable groups at high risk that is broadly commensurate with the proportion of infections attributable to vulnerable groups—there should be as little "wasted programming" for those at low risk as possible.
- Identifying the best buys—the most affordable, cost-effective, and appropriate interventions for each context.
- Identifying all major sites with large numbers of vulnerable group members.
- Carefully mapping and enumerating the size of vulnerable groups at high risk in each identified site.
- Routinely tracking program scope and coverage to ensure all or nearly all vulnerable group members are reached by programs.
- Developing and managing systems to routinely track quality to ensure the key determinants of success are preserved and delivered.
- Promoting and enforcing policies that reduce stigma, and advancing the rights of people living with HIV and the vulnerable groups who are most likely to contract HIV.
- Selectively assessing program impact, to ensure that approaches remain effective, and to provide evidence of implementation success for advocacy.

Source: Authors 2008.

greatest challenge. High coverage of preventive interventions among vulnerable communities is essential to reduce HIV transmission. HIV prevention among sex workers and clients, injecting drug users and their sexual partners, and men having sex with men and their sexual partners is relatively inexpensive and provides a high return on investment

(Disease Control Priorities by Jamison et al. 2006). Effective programs for sex workers, injecting drug users, men having sex with men, and the sexual partners of these communities can still prevent HIV from becoming widely established in the general population, and such action greatly reduces the need for treatment, care, and other costs. HIV priorities and investments should closely reflect the transmission patterns and their key structural determinants at the subnational level.

Regarding the situation in each of the South Asian countries (Moses et al. 2006), the key conclusions about the HIV epidemiology and the implications for the response to HIV are the following:

The future size of **India's** HIV epidemic will depend above all on the scope and effectiveness of programs for sex workers and clients, and also significantly on the scope and effectiveness of programs for men having sex with men and their other sexual partners, and injecting drug users and their sexual partners, particularly in the northeast. Throughout India, it remains vital to tackle stigma and discrimination toward people living with HIV. HIV prevention and AIDS treatment have reciprocal benefits: HIV prevention makes AIDS treatment more affordable and AIDS treatment creates important opportunities for enhanced HIV prevention.

The future size of **Nepal's** HIV epidemic will depend above all on the scope, coverage, and effectiveness of programs for injecting drug users and their sexual partners, and sex workers and clients. Sex between men constitutes a further risk, which must also be addressed. Nepal's longstanding political difficulties mean that civil society's already important role is even more critical, and that effective and creatively deployed international assistance is urgently needed.

Pakistan and Bangladesh's HIV epidemic will depend above all on the scope and effectiveness of programs for injecting drug users and their sexual partners, and men having sex with men and their sexual partners. Infection among sex workers is low and can be kept low through intensive programs for sex workers and clients, including a major focus on sex workers who inject drugs or whose sexual partners inject drugs. Stigma reduction is essential in order to achieve high-quality, high-coverage programs.

Despite limited data, **Afghanistan** has a large drug-using population and a growing injecting drug use community, who are highly vulnerable to HIV infection. It must act urgently to limit HIV infection in its large population of injecting drug users. For different reasons, **Bhutan, the Maldives, and Sri Lanka** have very low HIV prevalence and relatively small numbers of injecting drug users, sex workers, and clients. Early, effective, affordable programs for injecting drug users and their sexual partners, sex workers and clients, and men having sex with men and their sexual partners can ensure HIV remains very low in these countries. These countries have an opportunity they must not miss.

Annex 1

HIV Prevention Interventions

Prevention intervention	*Core services*	*Outcome (proxy) indicator*	*Opportunities to scale up coverage*
RTI/STI case management	Syndromic management (oral/anal STIs) single-shot options	% STI cases assessed and treated (and advised on consistent condom use and partner treatment)	Convergence with reproductive health programs/Integration into rural health and private sector care
Condom promotion	Promotion of knowledge and consistent use Increased access	% consistent condom use in different population groups	Education, health services/Strategic communications Transport sector/ Rural development-Private sector
Comprehensive IDU program	Needle, syringe exchange/Oral substitution/Residential care Drug de-addiction/Referral (for treatment of OI, TB and STI, voluntary counseling and Testing (VCT), ART	% HIV prevalence among injecting drug users	Community-driven services/NGO peer educators/Strategic communications/ Sensitization of police and legal system
MSM services	Commodity supply (lubricants & condoms)/Community-based response/risk-reduction services/ Referral STI services	% HIV prevalence among MSM	Community-driven programs/NGO peer educators/ Communications/ Sensitization of police and legal system

(continued)

HIV Prevention Interventions *(Continued)*

Prevention intervention	*Core services*	*Outcome (proxy) indicator*	*Opportunities to scale up coverage*
Workplace program	Workplace policy and protocols implemented (HIV and AIDS code, referral VCT, information, education & counseling (IEC), nondiscrimination	% of employees with access to HIV and AIDS information and services	Private sector/Labor unions
Blood safety program	Voluntary nonremunerated blood donation/Rational use of blood, HIV testing of blood units/quality assurance of blood banks	% HIV incidence of blood-borne transmission	Red Cross/Red Crescent Health systems
Youth-friendly services	Life skills (sexuality, substance abuse, etc.)/Health, education and other social services	% HIV prevalence among adolescents	Education sector, sports/Community-driven development schemes/ Social development programs
Migrant support center	Referral for VCT, STI, ART/Behavior change counseling/ Peer education		Transport sector, roads projects/ Social services/ Development programs
HIV preventive services for women	VCT, ARV Reproductive health services/ Prevention of mother-to-child transmission (PMCT)/Community-based response	% HIV-positive pregnant women	Convergence of reproductive health, TB program/ Community-driven services/Social development programs

Source: Adapted from Moses and others 2006

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CHAPTER 2

Responding to HIV in Afghanistan

Jed Friedman and Edit V. Velenyi

Introduction

Following almost three decades of war, Afghanistan is one of the poorest countries in the world. GDP per capita is estimated at about US$360 for 2007 (IMF 2007a). Life expectancy at birth is only 44.5 years (UNDP 2008), and maternal and child mortality are among the highest in the world. The literacy rate in the general population is very low (36 percent), especially for women (13 percent) (World Bank 2007).

There are very limited data available on the state of HIV and AIDS in Afghanistan. The number of known cases of HIV infections has been relatively low so far. However, there is a risk of an escalation in HIV prevalence owing to a high and increasing number of injecting drug users in the country. The experience from other countries across Asia suggests the potential for rapid spread of HIV within the drug-injecting population and onward transmission of the virus (Friedman and Des Jarlais 1991; Riehman 1998; Monitoring of the AIDS Pandemic (MAP) 2005; Ohiri 2006). At the same time, opium production in Afghanistan reached record levels in 2007 (IMF 2007b).

Keeping HIV prevalence low is one of the development objectives in Afghanistan. An increase in HIV and AIDS also has the potential to complicate progress in the attainment of other key development objectives.

A recent mapping of groups at high risk for HIV—IDUs and sex workers in three cities of Afghanistan (Chase 2008)—sheds some light on vulnerable groups at high risk in urban Afghanistan. The large numbers of returning refugees contribute to the spread of the epidemic, as many of them started injecting drugs while abroad. At the same time, lack of comprehensive harm reduction to prevent the spread of HIV and limited health system capacities imply that adequate prevention, care, or treatment are not available to many. The low social status of many affected by HIV and AIDS and the stigma associated with both risky behaviors and HIV and AIDS add to the challenges.

Against this background, control of HIV infections is a development priority in Afghanistan. While the level of HIV prevalence arguably remains low, the available evidence suggests that high vulnerability and risk are present and may contribute to an escalation of new HIV infections in Afghanistan. On the other hand, timely intervention activities proven to be cost-effective in a variety of settings may forestall or prevent such an occurrence. The first national HIV prevention project was launched in 2007, with a focus on targeted prevention programs, surveillance, strengthening management capacity and advocacy, and communications.

Section 2 discusses the state of the HIV epidemic in Afghanistan, summarizing the available data, discussing the social and economic context, and analyzing factors affecting the risk of transmission of HIV. Section 3 reviews the evidence on the effectiveness and cost-effectiveness of HIV preventions, with emphasis on interventions targeted at injecting drug users. Section 4 attempts an economic analysis of an HIV prevention program for Afghanistan and provides some measures of the economic effects of such a program. Section 5 summarizes the findings.

The State of the Epidemic in Afghanistan

An effective disease control strategy must respond to the nature and scope of the relevant disease patterns. We start out by summarizing the limited information available on the state of the epidemic in Afghanistan. Next, we discuss the social and economic context of the epidemic, including the country's history of conflict, which has resulted in destitution and a large number of refugees. The remainder of the section focuses on the role of injecting drug use and its implications for HIV transmission.

Stage and Scope of the Epidemic

The number of recorded AIDS cases in Afghanistan is low at present. The Ministry of Public Heath reported a total of 69 cases of HIV infection in Afghanistan in late January 2007, based on data from the Kabul blood bank and an HIV seroprevalence survey of injecting drug users in Kabul. A few months later (August 2007), the government reported 245 cases of HIV infection in Afghanistan (Saif-ur-Rehman et al. 2007). These data, however, likely substantially understate the actual number of people living with HIV in Afghanistan. UNAIDS (2006b) put HIV prevalence in Afghanistan at 1,000 people, with an "upper-range" estimate of up to 2,000 people, most of whom are male, and recent estimates have doubled.

Almost all the known cases of HIV infection in Afghanistan today are due to injecting drug use (IDU). A study of 464 injecting drug users in Kabul showed an HIV prevalence rate of above 3 percent, and highlighted the extremely high risk of the spread of the disease among injecting drug users and their partners, and to the general population (Todd et al. 2007).

While prevalence in the general population seems to be negligible, evidence shows that under a combination of unfavorable conditions[1] HIV prevalence in vulnerable groups can increase dramatically within short periods (see Claeson and Wilson, this volume). These conditions include the existence of multifaceted high-risk behavior, low education and social status, as well as weak health systems, severe public resource constraints, limited social responsibility, and lack of information, health education/promotion, and social marketing. According to a global review, in some of the 80 countries where HIV infections have been reported among IDUs, HIV has spread extremely rapidly within this group, with increases in seroprevalence of 20 to 40 percentage points within a single year (Friedman and Des Jarlais 1991). More generally, while HIV infections at present appear to be concentrated among IDUs, there is often intersection between IDU and sex work. HIV transmission among IDUs often serves as the entry point for HIV to spread to other vulnerable groups and the general population (Jha et al. 2001).

Given the initial stage of the epidemic in Afghanistan and the paucity of information, it is natural to also look to Afghanistan's neighbors as potential examples of future development. Central and South Asia are experiencing a rapid increase in HIV cases, with injecting drug use and the commercial sex trade as the major sources of HIV transmission

(UNAIDS 2006a). Iran has the highest rate of heroin addiction in the world: 20 percent of Iranians ages 15 to 60 are engaged in drug abuse, and between 9 percent and 16 percent of these inject drugs. In Tehran, 23 percent of IDUs are HIV positive; just one year earlier this prevalence stood at 15 percent (Zamani et al. 2005).

Context

Future transmission patterns of HIV in Afghanistan depend on the economic and social context and behavioral factors that determine risk profiles and transmission probabilities. Afghanistan is a conflict country, devastated by protracted armed conflicts since 1978. As a consequence, many factors associated with an increased risk of HIV transmission are present, including poverty, displacement of a population with high HIV prevalence to areas of lower prevalence, and sexual abuse or use of sex as a survival commodity.[2] The low levels of education, literacy, and health education contribute to the continuation of risky behaviors, particularly among IDUs. Illiteracy presents a severe barrier to HIV awareness and prevention. The literacy rate in the general population is very low (36 percent) and lower still among women (13 percent), with little popular awareness of HIV and AIDS and the protective effects of condom use (World Bank 2008). Women in Afghanistan experience one of the lowest social positions in the world. Denied access to education and jobs, and often not allowed to leave their homes without a male relative, they lack access to information on how to protect themselves (World Bank 2007).

The war has resulted in over 1 million widows, 1.6 million orphans, 0.5 million internally displaced people (DP), and 4 million Afghan refugees who returned from neighboring Pakistan and Iran (World Bank 2008). Today, still, about 4 million Afghans live in these countries, which have rapidly growing IDU-driven HIV epidemics of their own. Spillover of the epidemics from these countries raises grave concerns.

During the recent decades of conflict, up to 8 million Afghans fled to neighboring countries. Some Afghans began using and injecting heroin during their difficult years as refugees. In Quetta, a town in Pakistan bordering Afghanistan, for example, an HIV prevalence of 24 percent has been reported in a cluster of injecting drug users. These data have increased the fear of an epidemic in Afghanistan, since an estimated 4 million Afghans have returned home in the past few years.

The Iranian experience may be particularly relevant for the future of the epidemic in Afghanistan. HIV and AIDS is closely associated with injecting drug use in both countries, and a 2005 United Nations Office on Drugs and Crime (UNODC) report found that at least 50 percent of IDUs in Afghanistan reported to have started in Iran.

Iran has an estimated 200,000 injecting drug users (Razzaghi et al. 2006). Recent data indicate that 67.3 percent of HIV-positive cases and 85 percent of AIDS cases have a history of injecting drug use (Ministry of Health and Medical Education (MOHME) 2003). Furthermore, the HIV and AIDS epidemic in Iran appears to be accelerating rapidly. Between 2003 and 2005, the estimated population of those with HIV in Iran has increased from 37,000 to 66,000, the latter corresponding to 0.2 percent of the adult population (UNAIDS/WHO 2006).

Poverty in Afghanistan is both deep and broad, and can lead to increased risk of HIV infection. Impoverished, socially marginalized, and disempowered populations face access barriers to even basic care and information. There is an acute shortage of health facilities and trained staff, particularly female staff, in most rural areas. Of the facilities that exist, most are ill-equipped and unable to treat opportunistic infections or prevent mother-to-child transmission (MTCT) of HIV. Unsafe blood transfusion adds to the risk of HIV spreading to the general population, with only 30 percent of transfused blood being tested for HIV. People engaged in high-risk behaviors often have limited access to health care (World Bank 2007). At the same time, because it is located in the Golden Crescent, one of the major drug-producing areas and trafficking routs globally, access to drugs in Afghanistan is easy (Saifurrehman 2007; Ohiri 2006; World Bank 2007). Production of opium in Afghanistan reached record levels in 2007, with the estimated amount produced reaching 8,200 metric tons, an increase from the previous year of 34 percent, and amounting to 93 percent of the world's supply. The 2006 opium crop was estimated to have provided US$3.1 billion to Afghanistan, representing 32 percent of the entire national economy. Whereas almost all of the opium and heroin produced in the country was previously exported, 2 percent of the output is now believed to be consumed locally (UNODC 2007). Since production is now believed to exceed worldwide demand by a vast margin, large quantities are probably being stockpiled.

Behavior and Transmission Risk

As in many other traditional and deeply religious countries, estimation of the scale of the spread of HIV associated with IDUs, sex workers (SW), or men who have sex with men (MSM) is difficult in Afghanistan.

Local opinion varies as to the importance of these factors. Ex-inmates report that a substantial amount of drug injection occurs in Afghan prisons, a situation also reported in many other countries. Vulnerable groups potentially at risk of HIV infection include long-distance truck drivers and their helpers and the many abandoned children. Only 30 percent of transfused blood or blood products is currently tested for HIV (UNAIDS 2006b), which will be of increasing concern as HIV prevalence rises. There is much re-use of injecting equipment and other medical equipment in the formal and informal health care sectors, although there is little documentation about the extent and distribution of this practice.

As for the behavioral context and consequent risk of transmission, the sharing of contaminated injecting equipment is thought to confer the greatest risk of contracting HIV compared with other risk factors. Although the dominant routes of drug use in Afghanistan have previously been oral and inhalation, injecting practices are becoming increasingly prevalent. A 2005 survey estimated that Afghanistan has almost 1 million drug users, including 200,000 opium users and 19,000 injecting users, of whom 12,000 inject prescription drugs and 7,000 inject heroin. A 2006 survey in Kabul estimated that several categories of drug use had increased by more than 200 percent in 12 months (World Bank 2007). Most drug users were men, although the proportion of women among people using prescription drugs was high.

A recent study of the IDU population in Kabul showed that high-risk behaviors were very common: 35 percent had ever shared syringes; 76 percent had ever paid for sex with a woman; 27 percent of men had ever had sex with men; 23 percent had received so-called therapeutic injections in the previous six months; 4 percent had ever been paid for donating blood; and 35 percent had injected drugs in prison (Todd et al. 2006). The four viral samples assessed in the study had the same genome sequences previously identified in injecting drug users in Iran, where HIV prevalence is known to be much higher than Afghanistan. Moreover, the prevalence of hepatitis C—also predominantly spread by the sharing of injecting equipment—was already 37 percent, which indicates the very high risk of spreading blood-borne viruses in this population.

The high number of refugees and displaced people in Afghanistan, and of Afghan refugees and displaced people living in neighboring countries, is exacerbating the risk. Compared to Pakistani heroin users, displaced Afghan heroin users exhibit less knowledge regarding HIV transmission and engage in high-risk behavior (Zafar at al. 2003). They are also at risk due to isolation from their families and lack of means to support themselves.

The use of contaminated needles results in much higher risk of transmission than almost all other types of exposure (see annex table 2.1 for a comparison of risk behavior); hence reduction in these harmful practices is a policy priority. Injection frequency, size of the sharing network, and probability of sharing, drive changes in incidence. The higher the prevalence of HIV within a community, the more likely an instance of sharing can result in HIV transmission (Ball 1998; Hankins, Gendron and Tran 1994). For example, in a population with 10 percent HIV seropositivity, a new user injecting once a day has a 90 percent chance of using an infected needle within 21.5 days from onset of injecting. If the user injects three times a day, the number of days drops to seven; at a rate of five times a day, a new user has a 90 percent chance of using an infected needle within four days (Riehman 1998).

Simple estimates of expected incidence for different vulnerable groups (measures of risky behavior and HIV prevalence) have been useful to guide HIV prevention (Pisani et al. 2003). In the context of Afghanistan, the existing described facts, estimates, and listed behavioral risks pose a strong call for more qualitative analysis, simulations, and collection of observational data in order to better model the future course of disease transmission and to determine the most effective policy responses.

Evidence on the Effectiveness and Cost-Effectiveness of HIV Prevention

Policy makers are aware of the possibility that without preventive measures, Afghanistan may transition from the current low epidemic profile into the stage of concentrated epidemic, where HIV prevalence in key populations is above 5 percent. However, health policy decisions in countries such as Afghanistan are made under extreme resource constraints and informational uncertainty; a difficult double challenge. Additionally, reliable cost-effectiveness studies are lacking in low-income settings, and especially so in this context. Nevertheless, a review of cost-effective disease interventions offers some general lessons for policy priorities.

Effectiveness of Prevention

A general principle for prevention, especially relevant in the context of a low to concentrated epidemiological course, is that it is more important to change behavior of people with high-level or risk behavior than those with low risk (Bertozzi et al. 2006). Interventions targeting key populations with high-risk behavior are expected to be the most effective and efficient. Global experience suggests that if HIV epidemics associated with IDUs can be prevented or slowed, then the overall HIV epidemic can also be delayed (Ball, Rana, and Dehne 1998). Given the Afghan context, we primarily focus the discussion on the effectiveness and cost-effectiveness of preventive measures related to IDU.

Rapid increases of HIV prevalence among IDUs have usually been associated with a lack of awareness of AIDS as a local problem among IDUs, scarcity of sterile injection equipment, and the presence of other mechanisms for rapid and efficient transmission, such as law enforcement efforts that spur frequent movement among drug users (Des Jarlais and Friedman 1996). Harm reduction activities targeted to IDUs provide possible antidotes to these major drivers of risk (Needle et al. 1998). Harm reduction programs include simultaneously changing drug use practices (reduced injecting, use of alternate, noninjectable substances), needle practices (cleaning and reduced sharing of needles and syringes), and sexual behaviors (Ball 1998). Injection drug use also contributes to sexual transmission of HIV. Evidence from China indicates that younger IDUs have more sexual partners and are unlikely to use condoms (Wu et al. 1997). There is an association between injection drug use and commercial sex work for women (Ball 1998). Its spread among injection drug user populations to their non-IDU sex partners and their offspring is dependent on the mixing patterns between populations, as well as safer sex behavior practices. HIV prevention efforts targeting individuals injecting drugs should therefore include efforts aimed at reducing risks resulting from unprotected sex.

Annexes 2.2 and 2.3 in the annex provides a summary of intervention effectiveness and cost-effectiveness based on systematic review of the literature. General lessons that emerge from this review are the following:

- A number of regional reviews, which examine cost-effectiveness of HIV prevention in low-income countries, agree that health benefits can be best maximized if the next increment of funding is devoted to prevention, some non-highly active antiretroviral therapy (HAART) treatment, and care (Marseille, Hofmann, and Kahn 2002; Creese et al. 2002; Masaki et al. 2003; Hogan et al. 2005).

- While there is difficulty in teasing out which components are most effective in reducing HIV risk behaviors among IDUs, there is clear evidence that needle exchange programs, peer outreach, and oral substitution therapy are effective (Jha et al. 2001).
- Possibly effective interventions to interrupt HIV transmission among IDUs and between IDUs and other groups include programs promoting detoxification and abstinence, and programs targeting risky sexual behaviors of IDUs.
- Efforts to halt drug trafficking through increased surveillance, stiffer criminal penalties for suppliers and users, and other measures in the "war against drugs" generally have not been successful. New drug trafficking routes emerge as existing ones are patrolled or cut. A consequence of market globalization has been the diffusion of drugs into countries or regions that before had no history of injection drug use (Stimson, Adelekan, and Rhodes 1995).

Little has been published on the cost-effectiveness of harm reduction in a low-income context, partly because these interventions are not widely implemented. Given the low cost of syringes, the extremely high efficiency of HIV transmission by this route, and the demonstrated effectiveness of harm reduction programs in changing syringe-sharing behavior, needle exchange programs should be one of the most cost-effective interventions (Bertozzi et al. 2006).

Three studies on a harm reduction strategy in Belarus (Kumaranayake et al. 2004), Russia (Bobrik et al. 2004), and Ukraine (Vickerman et al. 2006), have explored the costs and cost-effectiveness of a harm reduction project working with IDUs. The results show that harm reduction is effective, with a cost of US$359 per HIV infection averted and US$18 per disability-adjusted life year (DALY) (Belarus); US$564 per HIV infection averted and US$28 per DALY (Russia); and US$97 per HIV infection averted (Ukraine). Two studies on a harm reduction strategy in Svetlogorsk, Belarus, have explored the costs and cost-effectiveness of a harm reduction project working with IDUs. Walker et al. (2003) found that the cost per person reached was US$1.19, and the cost per disposable syringe distributed was US$0.39. Using a mathematical model (Vickerman and Watts 2002), the cost-effectiveness of the Needle Exchange Program (NEP) project was estimated to be US$71 per HIV infection averted (Kumaranayake et. al. 2000). Yet studies note that as prevalence increases, harm reduction is likely not sufficient, but must be combined with other measures. In high-prevalence settings, harm reduction may reduce incidence, but not as much that it also reduces prevalence in the short term. This speaks to the need for assuring an effective harm reduction program in Afghanistan targeted toward IDUs in as timely a manner as possible.

There is some evidence on the cost-effectiveness of outreach to IDUs. In general, HIV prevention strategies for IDUs are highly targeted (Kumarayanake et al. 2000). Much of the behavior change and AIDS risk reduction that occurs among IDUs appears to occur through social processes (Trotter, Rothenberg, and Coyle 1995). For example, in a study of AIDS risk reduction among IDUs in Bangkok, Glasgow, New York, and Rio de Janeiro, talking with one's drug-using peers about AIDS was the one factor associated with risk reduction in all four cities (Seidman 1983; Des Jarlais and Friedman 1995). As for costs, an IDU outreach project in Kathmandu, Nepal, which relied on street-based outreach on foot, had a cost per client contact of US$3.21 (Söderlund et al. 1993).

The evidence indicates that harm reduction should be applied early in high-risk populations so the epidemic is controlled before it gets to the stage where additional resources and interventions are required even just to maintain the *status quo*. Alongside this international evidence, locally specific estimates of the relative social efficiency of investments in harm reduction activities can also help guide policy. The next section demonstrates a simple method to generate such estimates.

HIV Prevention in Afghanistan—An Economic Perspective

Building on our observations on the epidemiological situation in Afghanistan, and the lessons from our discussion of the effectiveness of prevention measures, the present section provides an economic perspective on a national HIV and AIDS prevention program being implemented in Afghanistan, specifically the activities supported by the Afghanistan HIV and AIDS Prevention Project supported by the World Bank.[3]

In our earlier discussion, we described the central role of injecting drug use in the transmission of HIV in Afghanistan. More generally, Wilson and Claeson (this volume) point at the intersection of injecting drug use and high-risk sexual behavior in the transmission of HIV. The Afghanistan HIV and AIDS Prevention Project (AHAPP) therefore is geared toward scaling up of prevention programs targeting people engaged in high-risk behaviors, notably injecting drug use and unsafe sex, including vulnerable groups at high risk, like IDUs, sex workers and their clients, truckers, and prisoners. Additionally, the project aims to improve the knowledge of HIV prevention among the general population, strengthen surveillance of HIV prevalence and high-risk behaviors, map and estimate the sizes of groups engaged in high-risk behavior, and use communications and advocacy to reduce stigma related to HIV and AIDS.

As noted earlier, obtaining an accurate picture of Afghanistan's current epidemiologic situation, let alone forecasting the future course of disease, is fraught with difficulties in this data-scarce environment. Nevertheless capturing and conveying the economic impact of prevention efforts requires forecasts of possible future courses of the disease. Afghanistan's neighbors may serve as one example. If Afghanistan were to follow the Iranian example described above, then an increase from less than 0.1 percent of the general adult population (ages 15–49) to 0.2 over five years represents a minimum of 16,000 new infections.[4] This hypothetical course of the epidemic in the absence of enhanced disease prevention serves as the baseline progression of the disease in Afghanistan for the economic analysis below.

There are numerous approaches commonly applied to assessing the economic consequences of HIV prevention measures. The two most common approaches are (1) an assessment that relates the costs of some measures to the benefits in terms of years of life saved or some other health measure such as the number of infections prevented, or (2) an assessment that relates the economic benefits of some intervention to its costs. Below, we apply each approach to assess the postulated economic benefits of an HIV prevention program in Afghanistan.

Afghanistan, with support from the World Bank, is planning to spend US$10 million over the next three years on the HIV and AIDS prevention project. This is part of a larger national operational program to which other donors also contribute, notably the Global Fund to Fight AIDS, Tuberculosis and Malaria. The World Bank support corresponds to a net present value of US$9.4 million.[5] Subsequently, the expected annual costs will be somewhat lower than in the initial period, at around US$3 million per year (table 2.1).

For the purposes of this exercise, the assumed impact of the project in its entirety on transmission is set at the deliberately conservative expected value of a 30 percent reduction in expected infections over the period 2007–10 (approximately equal to 4,800 infections averted). A conservative assumption of hypothesized impacts seems particularly germane given the information uncertainties previously discussed. With this assumption, disease prevalence in the overall adult

Table 2.1 Estimated Costs of HIV and AIDS Prevention Program in Afghanistan
(in U.S. dollars)

Activity	*Estimated cost*
Initial costs (2008–10)	$10,000,000
Annual costs (post-2010)	
Communication and advocacy	$404,400
Strengthening HIV surveillance system	$533,260
Targeted interventions for vulnerable groups at high risk	$1,457,400
Program management and monitoring and innovation fund	$580,800
Total	$2,975,860

Source: World Bank 2007 and authors' calculations.

population in five years time would be 0.03 percent less as a result of the program if the trajectory of the epidemic had followed the Iranian pattern. To further underscore the uncertainty of both intervention effectiveness and future disease transmission, we assume a standard deviation of 25 percent, or 1,200 infections averted, in outcomes. The uncertainty is expressed through a Monte Carlo analysis, where key parameters, such as infections averted, are treated as random variables. In each simulation, a new draw of infections averted is taken from the hypothesized distribution of this key parameter in order to explore the benefits of the project under various levels of effectiveness.

In order to estimate program costs per life-year saved—in the absence of more precise demographic and epidemiological information—it is necessary to make some assumptions regarding the number of life years saved per infection. The benchmark that we will use below is that one infection averted corresponds to 20 life-years saved. Judging from aggregate demographic estimates, this assumption appears to be conservative. In Afghanistan, the remaining life expectancy at age 20 is about 40 years, and it falls to 20 years only by age 50 (UN Population Division 2007). With most deaths due to HIV and AIDS occurring between ages 20 and 50, the effect on life-years saved could be much higher, based on these data. However, to the extent that HIV infections are driven by injecting drug use, and injecting drug users have a lower life expectancy even excluding the impacts of HIV and AIDS, the aggregate data would be misleading, so we adopt a lower benchmark of 20 life-years saved per infection averted. Given uncertainty over this estimate, we assume a standard deviation of four years, or 20 percent.

With discounted estimated project costs of US$9.4 million over the first three years, and an estimated 4,800 infections averted, the mean costs per infection averted comes out at US$1,960 per infection prevented. As the 4,800 preventions averted correspond to about 96,000 life-years saved, this translates into a cost of about US$98 per life-year saved. Given the stochastic assumptions concerning the effectiveness of prevention and the uncertainty over life-years saved, the cost per life-year saved ranges from US$47 to US$439. These estimates are summarized in table 2.2, which presents various benchmark percentiles in estimated outcomes. The majority of estimates, contained in the 10th to 90th percentiles, range over the shorter intervals of (3,194, 6,452) infections averted and (US$69, US$161) per year of life saved.

With additional assumptions, the benefits from prevention activities can be translated into a monetary equivalent in order to compare directly with program costs. The monetized benefits from a reduced number of HIV infections are here determined as the sum of three factors: the costs of medical treatment forgone, the value of lost earnings for people living with HIV and AIDS (PLWHAs) given increased mortality, and the value of lost earnings for the typically familial and unpaid caretakers. These are some of the more direct costs of infection. Additional costs require even further assumptions and so the analysis makes no attempt either to directly value the years of life lost due to premature mortality or to cost the pecuniary savings from a reduction in tuberculosis and other opportunistic infections transmitted to HIV-negative individuals. Clearly, taking these values into account will substantially increase the estimated benefits depicted here.

Wage and earnings information for Afghan workers is incomplete and often of questionable validity. One careful small-scale longitudinal study conducted in three urban centers (Kabul, Herat, Jalalabad) estimate mean annual earnings to be US$425 (Beall and Schutte 2006) (see table 2.3). Since this study spans a 12-month period, it includes seasonal spells of underemployment and unemployment. Approximately 80 percent of earners are male, so this wage estimate is heavily weighted toward male earners. There are no direct estimates of wage earnings among IDUs or their likely sexual partners. Furthermore, there are no direct estimates of wages earned by recovered IDUs who are no longer injecting. Given these uncertainties, and the fact that the majority of IDUs are male, this study directly adopts the estimate of earnings mentioned above. Real wages are set to grow an average of

Table 2.2 HIV Prevention Program: Costs and Years of Life Lost (YLL) Averted
(costs in U.S. dollars)

	Percentile						
	1st	*10th*	*25th*	*50th*	*75th*	*90th*	*99th*
Total program cost	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
Present value of total program cost	9,399,600	9,399,600	9,399,600	9,399,600	9,399,600	9,399,600	9,399,600
Number of infections averted	2,087	3,184	3,891	4,907	5,764	6,452	7,202
Total averted YLL	35,908	58,283	72,991	95,152	119,173	136,899	185,777
Present value of cost of YLL averted	262	161	129	99	79	69	51

Source: Authors' calculations.

Table 2.3 Cost Parameters
(in units indicated)

Average annual earnings of all workers	US$425
Mean annual real wage growth (random variable)	3%
Standard deviation of annual real wage growth	0.5%
Average wage loss for caregivers, in final year of illness	US$212
Average private health care costs, excepting final year of life	US$60
Average public health care costs, excepting final year of life	US$60
Average private health care costs in final year of life	US$420
Average public health care costs in final year of life	US$420
Discount rate applied	5%

Source: Beall and Schutte 2006; Johns Hopkins University 2006; Author's assumptions.

3 percent a year (in line with economic projections), with a standard deviation of 0.5 percent. This additional source of variation ensures that every simulation will have unique real wage growth rates.

When infected individuals fall sick, they need care, and the cost of forgone earnings for the caretakers is another substantial cost. For example, in Vietnam, three-quarters of PLWHAs interviewed in a recent UNDP-sponsored qualitative study claimed they required the assistance of a caregiver on average for five hours a day. A quarter of caregivers reported having to give up a job in order to spend time with the infected person (UNDP 2004). This analysis sets the expected earnings loss for caregivers at one-half of annual earnings, and this loss occurs in the final year of life for PLWHAs, when they are most in need of home care.

The expected lifespan, after infection, of a PLWHA is assumed to be nine years, and an enhanced level of health care will be necessary in the final five years, with the final year of life preoccupied with even greater medical care (Zaba et. al. 2004). Little information on the costs of care for PLWHAs, both out-of-pocket private expenditures and public sector spending, exists in Afghanistan. A combined facility and household survey estimates that 49 percent of total Afghan health spending was out-of-pocket private expenditure (Johns Hopkins University 2006). The same study estimates that the average monthly expenditure for a sick adult presenting to a health facility is US$20. This analysis assumes that after an HIV-positive individual begins to suffer from opportunistic infections and falls ill, by the fifth year of infection, he or she will present three times annually to a health facility, for an average private cost of US$60 a year. The study further assumes an equal amount of resources in the public sector is devoted to that individual's care (since the amount of spending in the health system from private and public sources is estimated to be roughly equal).

It is to be expected that this level of care, including the maintenance of opportunistic infections, will be necessary for several years, while in the final year the costs are expected to rise substantially. The same UNDP-sponsored Vietnam study referenced above found that the average per-capita health expenditure per PLWHA rose sevenfold in the final year of life (UNDP 2004). This study takes the same multiplier and applies it in the Afghan context. Hence, public and private spending each averages US$420 in the final year of life for a PLWHA.

Table 2.4 summarizes the results of our estimates and simulations. The median present value of total costs averted is estimated at US$30.8 million, yielding a gross benefit-cost ratio of 3.28. Indeed, almost every point in the range of possible outcomes is associated with a substantially higher present value of total costs averted. In only one simulation (out of 500) is the estimated gross benefit less than cost. Given that these rough calculations—based on deliberately conservative assumptions—show a positive return, and often a substantially positive return, we find that effective harm reduction activities can result in significant savings for Afghanistan as a whole.

These savings are further increased when reduced demand for health services is also taken into account. The median present value of savings to the health care system due to reduced system expenditures on PLWHAs is estimated at US$2.04 million, resulting in a net program cost of US$7.36 million and a net benefit-cost ratio of 4.19. Between the 1st and the 99th percentile, the benefit-cost ratio ranges between 1.47 and 7.59. These ranges of gross and net benefit-cost ratios calculated here are consistent with the ratios found in other countries in the region, especially when the conservative estimates of program impact are taken into account. Even with these very conservative assumptions on program impact, made in a data-scarce environment, the anticipated net benefits are substantial.

Conclusions

While HIV prevalence in Afghanistan is low, the large number of IDUs suggests the potential for an escalation of HIV prevalence, both within the drug-injecting population, and onward transmission of the virus. Many of

Table 2.4 HIV Prevention Program: Costs and Outcomes
(costs in U.S. dollars)

	Percentile						
	1st	*10th*	*25th*	*50th*	*75th*	*90th*	*99th*
Total program cost	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
Present value of total program cost	9,399,600	9,399,600	9,399,600	9,399,600	9,399,600	9,399,600	9,399,600
Number of infections averted	2,087	3,184	3,891	4,907	5,764	6,452	7,202
Present value of total costs averted	12,539,100	19,481,900	24,545,100	30,801,800	36,647,600	41,415,300	48,592,700
Present value of public costs averted	869,100	1,326,100	1,620,600	2,044,000	2,400,800	2,687,400	2,999,800
Net program cost	8,530,500	8,073,500	7,779,000	7,355,600	6,998,800	6,712,200	6,399,800
Gross program costs per HIV infection averted	4,504	2,952	2,416	1,916	1,631	1,457	1,305
Gross benefit-cost ratio	1.33	2.07	2.61	3.28	3.9	4.41	5.17
Net program costs per HIV infection averted	4,087	2,536	1,999	1,499	1,214	1,040	889
Net benefit-cost ratio	1.47	2.41	3.16	4.19	5.24	6.17	7.59

Source: Author's calculations.

the IDUs are returnees, and the refugee situation also contributes to the spread of the epidemic geographically, a situation amplified by poverty, lack of access to information about HIV and AIDS, and the lack of effective prevention interventions, such as harm reduction.

The second part of this chapter (Prevention in Afghanistan—An Economic Perspective) describes a model calibrating the costs and economic benefits of a comprehensive HIV prevention program. In light of the very limited knowledge about the state of the epidemic in Afghanistan, it allows for some uncertainty regarding intervention effectiveness or disease dynamics. The median estimates return a cost-benefit ratio of 3.3, which increases to 4.2 when fiscal savings arising from reduced demand for public health services are taken into account. These results, when considered alongside the international evidence on cost-effectiveness, reinforce the view that Afghan investments in effective harm reduction activities constitute not solely good health policy, but sound economic policy as well.

Annex 2.1 Estimated HIV Transmission Probabilities by Exposure

Type of exposure	*Estimated risk*
Receptive Anal Intercourse	≤ 3% (1/125 to 1/31) (DeGruttola et al. 1989)
Receptive Vaginal Intercourse	≤ 0.1% (1/2,000 to 1/677) (Mastro et al. 1994; Wiley, Herschkorn, and Padian 1989)
Insertive Vaginal or Anal Intercourse	≤ 0.1% (1/3,000 to 1/1,111) (Nagachinta et al. 1997; Peterman et al. 1988)
Needlestick Injury	= 0.3% (1/313) (Henderson et al. 1990)
Use of Contaminated Injecting Drug Equipment	= 0.6% (1/149) (Kaplan and Heimer 1992)

Source: Bertozzi et al. 2006.

Annex 2.2 Evidence on Effectiveness of Harm Reduction in Injecting Drug Users (IDUs), and Other Preventive Measures

Intervention	*Outcome*	*Impact/policy implication*	*Methodology*	*Country/region*	*Source*
Various Methods of Harm Reduction	HIV Incidence	Significant reduction in HIV incidence in the intervention group was found in both studies.	Meta-analysis	Global[6]	Des Jarlais and Friedman 1996
Outreach to IDUs	Reduced risk behavior	The baseline to follow-up measurements showed substantial reductions in HIV risk behavior in the National AIDS Demonstration Research studies. However, only a few of the NADR projects showed significantly greater risk reduction in the "enhanced" versus the "standard" interventions.[7]	Randomized clinical trial	50 cities in the United States	Friedman and Des Jarlais 1991
Bleach Disinfection	HIV incidence	2 studies (Baltimore and New York) found no protective effect of self-reported bleach disinfection, while the third (Miami) found a moderately strong protective effect.[8]	Cohort studies using multivariate analysis	Baltimore, New York, and Miami	Vlahov et al. 1994; Titus et al. 1994; Weatherby et al. (in Des Jarlais and Friedman 1996)
Bleach Disinfection	Life-years saved and change in cohort HIV prevalence	Bleach programs can produce the greatest life-year (LY) savings in areas of low HIV prevalence. In the lowest prevalence scenario (0.02), the projected LY savings is 2.3 years/HIV negative drug user, compared with 1.7 and 1.3 under medium (0.25) and high prevalence (0.60). The results suggest the introduction of bleach programs early, when prevalence is still comparatively low in the IDU population.	Markov model simulation 4 hypothetical cohorts of IDUs	Data for simulation: urban health study, San Francisco	Siegel et al. 1991

(continued)

Annex 2.2 Evidence on Effectiveness of Harm Reduction in Injecting Drug Users (IDUs), and Other Preventive Measures (*Continued*)

Intervention	*Outcome*	*Impact/policy implication*	*Methodology*	*Country/region*	*Source*
Syringe Exchange (SE)	HIV incidence	Low: HIV incidence among syringe-exchange participants is uniformly low in areas with low HIV seroprevalence.[9] Participants in the syringe exchange program in Kathmandu, Nepal, have a low HIV incidence rate (Maharjan et al. 1994[10]). Intermediate: The two cities with intermediate HIV seroprevalence levels (London and Montreal) show strong contrast. HIV incidence among Montreal[11] SE participants was 6/100 person-years at risk. High: Results from syringe-exchange programs in the high-seroprevalence areas are generally encouraging. Syringe-exchange programs in these areas are not sufficient to eliminate all new HIV infections, but the pattern is clearly one of relatively low rates of new HIV infections.	Meta-analysis	Global	Des Jarlais and Friedman 1996 (based on Des Jarlais, Report to UK Health Department, Hankins personal communication)
Needle Exchange (NE)	Re-use/Sharing of syringes	Significant reduction in needle sharing in the intervention group was found in all three studies; correlation between needle exchange program attendance and lower needle sharing was found in one study.	Empirical analysis[i] Meta-analysis I[ii]	Bangladesh[i] Global[ii]	[i]Jenkins et al. 2001; [ii]Ksobiech 2003; Peak et al.,1995; Vlahov et al. 1997

Needle Exchange (NE)	HIV infection	On average, seroprevalence increased by 5.9% per year in the 52 cities without NE programs (NEPs), and decreased by 5.8% per year in the 29 cities with NEPs. The average annual change in seroprevalence was 11% lower in cities with NEPs (95% CI −17.6 to −3.9, $p = 0.004$). Results, together with the clear theoretical mechanisms by which NEPs could reduce HIV incidence, strongly support the view that NEPs are effective.	Meta-analysis of NEPs in 80 cities, combined with unpublished information from the CDC on seroprevalence of IDUs entering treatment in the United States between 1988 and 1993.	Global	Hurley, Jolley, and Kaldor 1997
Needle Exchange (NE)	HIV infection	Starting from prevalence rates for 23% (whites) and 88% (natives), based on 24 seroconversions among 257 follow-up visits, estimated HIV incidence was 18.6 per 100 person-years (95% confidence interval, 11.1–26.0). Despite having the largest NEP in North America, Vancouver has been experiencing an ongoing HIV epidemic. Whereas NEPs are crucial for sterile syringe provision, they should be considered one component of a comprehensive program including counseling, support, and education.	Prospective study. logistical regression of semiannual case-control data on 1,000 IDUs, reached through street outreach or self-referred to NEP	Vancouver	Strathdee et al. 1997

Annex 2.3 Evidence on Cost-Effectiveness of Harm Reduction in Injecting Drug Users (IDUs) and Other Prevention and Treatment Measures

Outcome	*Impact/policy implication*	*Methodology*	*Country*	*Source*
Cost/Intervention and Cost-effectiveness (CE)	The most effective harm reduction is eliminating drug use. In a street-based outreach in Kathmandu, Nepal, cost per client contact was US$3.21. In Svetlogorsk, Belarus, cost per person reached was US$1.19, and the cost per disposable syringe distributed was $0.39. Using a mathematical model, the CE of the project was estimated to be US$71 per HIV infection averted.	Systematic review[12]	Developing countries	Walker 2003
Cost/HIV Averted/ Treated, Total LYs Gained, and Cases Averted/Treated	Both the cost-effectiveness and the budgetary analysis suggest that HIV prevention interventions are much more cost-effective than ARV treatment. Both blood screening and STD control among sex workers are the most CE preventive interventions at the costs of US$3.35 and US$3.95 per life-year saved, respectively. ARV treatment is the least cost-effective, costing US$1,317 per life-year saved at generic drug prices. In the budgetary simulation scenario with donated drugs, ARV treatment consumes the entire budget, saving up to 2,974 life-years annually. A portfolio of prevention interventions does not require the entire budget and results in 135,030 life-years saved. HIV prevention interventions should be prioritized if poor countries hope to maximize the scarce resources available for reducing the impact of the AIDS epidemic.	Comparative CEA of HIV treatment and prevention[13] and static budgetary simulation	Resource- scarce countries	Masaki et al. 2003

Cost/Intervention and Cost-effectiveness (CE)	(i) Median costs in NEP per participant contact range from US$1.35 in the United States to US$3.21 in Nepal. Cost-benefit analysis (CBA) of NEPs found ranges of the cost per HIV infection averted in the United States to be between US$3,800 to almost US$100,000, below the estimated lifetime cost of treating an HIV-infected person (Lurie et al.1997). (ii) Annual costs of methadone maintenance in the United States run US$5,250 per person, based on an analysis of 600 programs conducted by Barnett et al. 2001. (iii) The supply control strategies being employed in many African countries, for example, have demonstrated only limited effectiveness based on reports of increasing trading activities and drug availability.	Systematic review of effectiveness and cost-effectiveness	Low- and middle-income countries	Jha et al. 2001
HIV Infection and DALYs	US$359/HIV Infection US$18/DALY	CEA (Financial and economic cost) modeling[14]	Belarus	Kumaranayake et al. 2004
HIV Infection and DALYs	US$564/HIV infection US$28/DALY	Empirical	Russia	Bobrik 2004
HIV Infection	US$97/HIV infection (Between 1999 and 2000, at the coverage of between 20% to 38%, and an IDU HIV prevalence of 54%, projections suggest 792 HIV infections were averted, a 22% decrease in IDU HIV incidence, but a 1% increase in IDU HIV prevalence. Cost per HIV infection averted was US$97. Scaling up the intervention to reach 60% of IDUs remains CE and reduces HIV prevalence by 4% over five years. At the current coverage, the harm reduction intervention in Odessa is CE but is unlikely to reduce IDU HIV prevalence in the short term. To reduce HIV prevalence, more resources are needed to increase coverage.	Mathematical modeling of economic providers' costs with empirical data	Odessa, Ukraine	Vickerman et al. 2006

(continued)

Annex 2.3 Evidence on Cost-Effectiveness of Harm Reduction in Injecting Drug Users (IDUs) and Other Prevention and Treatment Measures (*Continued*)

Outcome	*Impact/policy implication*	*Methodology*	*Country*	*Source*
HIV Infection CER	CER US$20,947/HIV infection	CEA using cost and process data. Alternative estimates calculated using published data and simplified circulation model. HIV treatment cost taken from literature.	New York	Laufer 2001

Source: Authors (Expanded from Bertozzi et al. 2006).

Notes

1. Unfavorable conditions include rate and pattern of sexual partner change, the presence or absence of male circumcision, and injecting drug use—frequently coupled with sex work. War—through increased mobility and psychological distress—can amplify the problem, increasing the number of displaced people and refugees, and drug-injecting prisoners. Disempowerment of women and fragmented social networks are further contributing factors to increased likelihood of HIV transmission in vulnerable groups.
2. Wollants et al. (1995), and Smallman-Raynor and Cliff (1991) discuss the implications of armed conflict for the spread of HIV/AIDS in El Salvador and the Central African Republic, respectively.
3. For more information, see http://go.worldbank.org/GL463NSC10.
4. This assumes a mortality rate of 15 percent over the next five years for individuals already or soon to be HIV positive).
5. Our analysis adopts a discount rate of 5 percent, a typical value for the evaluation of health projects.
6. Studies classified as "global" are skewed toward research in developed countries.
7. The National AIDS Demonstration Research (NADR) program was an outreach program to IDUs not in treatment in 50 cities in the United States, which randomly assigned individual subjects to "enhanced outreach" intervention (treatment group) and "standard outreach" (control group). *Standard Intervention* includes: risk behavior interview, HIV counseling and testing (VCT), and basic AIDS education. *Enhanced Intervention* includes: additional hours of individual or small-group counseling and skills training
8. Potential reasons for failure of bleach disinfection: IDUs not following adequate disinfection procedures; formidable measurement problems (difficult to measure "good" disinfection and therefore identify valid control group); need to distinguish between IDUs using only sterile/unused equipment, IDUs using bleach disinfection, and IDUs not using bleach disinfection; and IDU injection practices vary (Des Jarlais and Friedman 1996).
9. This in part reflects the dynamics of HIV transmission, where "equal" risk-reduction programs will have greater impact if they are implemented when seroprevalence is low.
10. Maharjan et al. (1994) was the first report of a successful SE program in a developing country.
11. The reasons for the high incidence rate among Montreal syringe-exchange participants have not yet been determined (Bruneau, personal communication by Des Jarlais), but may include: (1) attracting a group of participants at extremely high risk for HIV infection; and (2) an insufficient number of

syringes exchanged per visit, given the high frequency of drug injection among the participants.

12. Databases: Medline, HealthStar, Popline, Health Economic Evaluation Database (HEED), ISI, Science and Social Sciences, Embase, and Cab Health; and correspondence with donor organizations.
13. This study examined five prevention interventions: (1) voluntary counseling and testing; (2) prevention of mother-to-child transmission; (3) STD mass treatment for general population; (4) STD management for sex workers; and (5) blood screening, and four drug price scenarios for ART for HIV-positive patients.
14. Kumaranayake et al. (2004) undertake an analysis of the cost-effectiveness of a harm reduction and HIV prevention project for IDUs in Eastern Europe. Economic evaluation methods were adapted to consider the effect of an eight-month financing gap that negatively impacted project implementation. Financial and economic costs of implementing the intervention were analyzed retrospectively. The data were also modeled to estimate the costs of a fully functioning project. Estimates of the intervention impact on sexual and drug injecting behavior were obtained from existing pre- and postintervention behavioral surveys of IDUs. A dynamic mathematical model was used to translate these changes into estimates of HIV infections averted among IDUs and their sexual partners. Projections of the potential effect of the shortfall in funding on the impact and cost-effectiveness of the intervention were made. In Svetlogorsk, Belarus, where in 1997 the IDU HIV prevalence was 74 percent, the intervention averted 176 HIV infections (95 percent CI 60–270) with cost-effectiveness of US$359 per HIV infection averted (95 percent CI US$234–US$1,054). Without the US$2,311 reduction (7 percent) in financing, the estimated cost-effectiveness ratio of the project would have been 11 percent lower. The costing methods used to measure donated mass media can substantially influence cost and cost-effectiveness estimates. Harm reduction activities among IDUs can be cost-effective, even when IDU HIV prevalence and incidence is high. Relatively small shortfalls in funding reduce impact and cost-effectiveness. Increased and consistent allocation of resources to harm reduction projects could significantly reduce the pace of the HIV epidemic in Eastern Europe.

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PART II

The Economic and Development Impacts of HIV and AIDS

CHAPTER 3

Development Impact of HIV and AIDS in South Asia

Markus Haacker

Introduction

The epidemiology of HIV and AIDS in the countries of South Asia and the economic context in which the epidemic takes place are very different from those in high-prevalence countries, which have motivated most of the studies on the economic development implications of HIV and AIDS. The extent to which South Asia can learn from the literature is therefore unclear. Against this background, the present chapter takes stock of the development impacts of HIV and AIDS. Specifically, the chapter addresses two objectives. First, in addition to providing some summary indicators of the impacts of HIV and AIDS (such as key health indicators, or economic growth), the chapter analyzes the impacts of HIV and AIDS on a microeconomic level and across population groups. Second, the chapter discusses the interactions of the ongoing response to HIV and AIDS with development impacts across population groups.

Among the consequences of HIV and AIDS that can be most directly measured or estimated are the **health and related demographic impacts** (section 2). In light of the overall low HIV prevalence rates in the region, the section discusses the contribution of HIV and AIDS to the burden of disease (including comparisons with other diseases). Next, it provides estimates of the impacts of HIV and AIDS on key demographic variables, such as the mortality rate, the population growth rate, and life expectancy. Finally, it discusses some of the consequences of the socioeconomic profile of the epidemic.

Section 3 addresses **aggregate measures of the economic impact of HIV and AIDS.** First, we discuss the magnitude of the impact of HIV and AIDS on economic growth. Second, we present estimates of the welfare effects of HIV and AIDS that more explicitly account for the increased risks to health and life. The section concludes with a discussion of the shortcomings of such aggregate approaches; in particular, they do not capture development implications of HIV and AIDS that arise when the impact of HIV and AIDS is asymmetric across population groups.

Section 4 summarizes the available information on the **impact of HIV and AIDS across population groups.** The main part of this section deals with the economic impact and coping, discussing issues such as the income and employment losses associated with HIV and AIDS, other adverse impacts like stigma, the role of caregiving, and the burden of medical expenditures. Where available, we present data on differences in the impact of HIV and AIDS across population groups, for example, differentiating by wealth. One item on which we place particular emphasis throughout this section is the gender dimension of HIV and AIDS (HIV awareness, economic impact); a separate section deals with the impact on orphans.

Section 5 focuses on challenges associated with and development aspects of the response to HIV and AIDS. One key aspect of the response is **access to prevention**. Effective prevention is crucial not only in terms of containing the scale of the epidemic and its economic impact, but also for a successful and sustainable scaling up of treatment, with the aim of containing pressures on health services in the future. Meanwhile, **access to treatment** has the potential of mitigating the health and economic impacts of HIV and AIDS. At the same time, inequities in access to treatment can be an important source of inequities in the development impact of HIV and AIDS, and exacerbate its impact on key development indicators, e.g., those related to poverty. We focus on two main issues. First, we analyze access to treatment on the country level (which—in an international context—is low in South Asia), and discuss potential impediments to the scaling up of treatment in South Asia. Second, we discuss the limited evidence regarding inequities in access to treatment, using both data on access to health services in general and summarizing the (very limited) direct evidence on access to antiretroviral treatment across population groups.

The picture that emerges regarding the economic development impacts of HIV and AIDS is complex. We find the impact of HIV and AIDS on economic growth in South Asia to be very small, especially when compared with the high growth rates realized in most of the region. However, the welfare implications, taking into account the impact of increased mortality, are by no means negligible. Meanwhile, we find that the most relevant implications of HIV and AIDS in an economic development context arise on a subnational level, in terms of inequities according to socioeconomic status (wealth, access to education) regarding the susceptibility to HIV and AIDS and the ability to cope with the economic impact. Also, we present evidence regarding an asymmetric impact of HIV and AIDS on women, arising particularly from the socioeconomic consequences of widowhood. Finally, we note that access to treatment in the region is low in an international context, and present evidence that points to weaknesses in health systems as a factor not only impeding progress in extending access to treatment, but also as a factor in exacerbating inequities in terms of the socioeconomic impact of HIV and AIDS.

Health and Demographic Impacts of HIV and AIDS

HIV prevalence in Asia is relatively low in an international context, especially when compared against regions that have inspired much of the literature on economic or development impacts of HIV and AIDS. The role of HIV and AIDS as an economic development issue in the region—particularly in the context of the broader development agenda objectives, such as the MDGs—therefore is not as prominent or obvious as for countries where HIV and AIDS have assumed catastrophic proportions.

One of the recognizable aspects of the health impact of HIV and AIDS is increasing mortality. Estimates of mortality attributable to AIDS and other diseases and conditions provide an indicator for the relative contribution of AIDS to the burden of disease in a country or region. WHO (2006c) also allows assessments of the burden of disease in terms of losses of disability-adjusted life years (DALYs). The findings are similar to the one presented here for mortality, with AIDS accounting for 1.3 percent of DALYs lost in South Asia overall, and 1.8 percent of DALYs lost in India. This partly reflects that HIV and AIDS primarily affect working-age adults, while diseases primarily affecting children have a larger weight in terms of losses of DALYs, and diseases associated with old age correspondingly carry a lower weight. The average loss in DALYs associated with an AIDS-related death thus happens to be close to the average loss in DALYs across all deaths. Estimates of the causes of deaths by country are available from WHO (2006c) for 2002 (see also Lopez and others 2006). To assess the mortality associated with HIV and AIDS in South Asia, however, it is important to recognize that estimates of AIDS-related mortality have since been revised, especially for India. To obtain a more accurate estimate of mortality associated with AIDS, we therefore substitute adjusted estimates of AIDS-related deaths in India (about 190,000 in 2005; see table 3.1) for the earlier WHO estimates (about 360,000; see WHO 2006c).

Figure 3.1 illustrates the mortality associated with AIDS in the region (the eight countries covered by the World Bank's South Asia Region, see table 3.1), as well as for India. Overall, AIDS accounts for 1.5 percent of all deaths in South Asia, about the same level as measles or diabetes. For India, the share of deaths attributed to AIDS is higher, at about 2 percent, slightly more than half the level of deaths from tuberculosis.

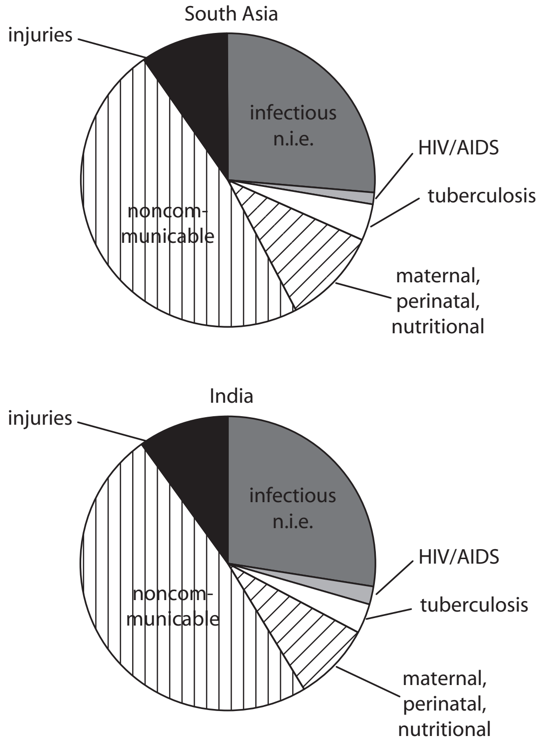
The mortality estimates also allow for comparisons between countries in terms of the state of health systems. We illustrate this point with a comparison between India and the United States. Controlling for the age structure of the population, mortality associated with HIV and AIDS in India was about five times higher than in the United States, even though

Table 3.1 South Asia: Key HIV and AIDS Statistics

	HIV prevalence, ages 15–49 (percent)		*People living with HIV and AIDS*		*Share of women among PLWA*	*AIDS deaths*	
	2007	*2001*	*2007*	*2001*	*2007*	*2007*	*2001*
Afghanistan	<0.01	<0.01	<1,000	<500	n.a.	<100	<100
Bangladesh	0.01	<0.01	12,000	7,500	16.7	<500	<100
Bhutan	0.09	<0.01	<200	<100	n.a.	<100	n.a.
India	0.34	0.46	2,400,000	2,700,000	36.7	= 190,000	n.a.
Maldives	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Nepal	0.5	0.5	70,000	56,000	17.1	4,900	2,600
Pakistan	0.10	0.07	96,000	51,000	28.1	5,000	1,900
Sri Lanka	0.03	0.03	3,800	3,000	36.8	<500	<200
Memorandum Items							
Cambodia	0.8	1.5	75,000	120,000	26.7	6,900	14,000
China	0.08	0.06	700,000	470,000	28.6	39,000	15,000
Thailand	1.4	1.7	610,000	660,000	41.0	31,000	66,000
Myanmar	0.7	0.9	240,000	300,000	41.7	24,000	24,000

Sources: UNAIDS/WHO (2008) and author's calculations.
Note: AIDS deaths for India approximated based on the midpoint of estimates included in UNAIDS (2006a), adjusted for revisions in the estimated for HIV prevalence in India that have occurred meanwhile. The number of deaths for India relates to 2005, not to 2007.

Figure 3.1 South Asia and India: Contribution of AIDS to Mortality



Source: Author's calculations, based on WHO (2006c) and UNAIDS, NACO, and WHO (2007).
Note: n.i.e. = not included elsewhere.

HIV prevalence was lower in India (about 0.4 percent, as compared to 0.6 percent).[1] Thus, relative to the number of people living with HIV and AIDS, the estimated number of AIDS-related deaths in India is eight times higher than in the United States.

Table 3.1 presents key indicators for the state of HIV and AIDS in South Asia, based on the *2008 Report on the Global AIDS Epidemic* (UNAIDS and WHO 2008). Overall, the number of people living with HIV and AIDS in the region is about 2.6 million, of whom the lion's share are located in India (in line with its population weight, but also reflecting that HIV prevalence is higher there than in the other countries in the region, except for Nepal). The number of AIDS deaths amounted to about 200,000 (based on a crude approximation for India, see above). The countries covered differ significantly in terms of the share of women among the people living with HIV and AIDS, which ranges from about

17 percent (Bangladesh, Nepal) to about 37 percent (India, Sri Lanka). Overall, the number of people living with HIV and AIDS in the region is estimated to have declined between 2001 and 2007, owing to an estimated decline in the number of people living with HIV and AIDS in India, while the estimated numbers increased for every other country in South Asia where estimates were available.

One point worth noting about table 3.1 regards the availability of estimates of the scale of the epidemic in some countries under consideration. First, no estimates are available for Maldives; for this reason, the country will not be included in the tables summarizing the demographic or economic impacts of HIV and AIDS. Point estimates for most variables are also not available for Afghanistan and Bhutan, so these countries will also not be included in our analysis below.

In order to address the impact of HIV and AIDS for the economies in question, it is necessary to understand the impacts of HIV and AIDS on key demographic indicators. To this end, we face several challenges. The most comprehensive estimates of the demographic impacts of HIV and AIDS are those by the UN Population Division. However, among the 62 countries for which the UN Population Division (2007) provides counterfactual estimates of a "no-AIDS" demographic scenario, there is only one South Asian country (India). For this country, the demographic projections are based on estimates of HIV prevalence that have been superseded by the more recent ones discussed above. Our estimates of the demographic impact of HIV and AIDS in India are therefore based on those from the UN Population Division (2007), but scaled to account for an updated lower estimate of HIV prevalence. For the other countries, we assume that the impacts of HIV and AIDS on key demographic indicators, adjusted for the scale of the epidemic, are similar to those in India, and therefore apply coefficients derived from the estimates for India.[2] To provide a wider regional context, we also report demographic indicators for some other Asian countries, especially those with large numbers of people living with HIV and AIDS.

We find that HIV and AIDS do have a perceptible impact on key demographic indicators (table 3.2). Life expectancy at birth in India and Nepal declines by about half a year, the rate of population growth declines by about one-tenth of a percentage point, and mortality rates increase by 0.2–0.3 per 1,000 (meaning that in India and Nepal, one in 36 or one in 25 deaths, respectively, are estimated to be AIDS-related). Taking a broader Asian perspective, we see that, in the countries where estimated HIV prevalence exceeded 1 percent (Cambodia, Thailand), life

Table 3.2 The Demographic Impact of HIV and AIDS in Selected South and East Asian Countries

	HIV prevalence, ages 15–49 (Percent)	*Crude death rate (Per 1,000)*	*Crude death rate: Impact of HIV and AIDS*	*Population growth (Percent)*	*Population growth: Impact of HIV and AIDS*	*Life expectancy at birth (Years)*	*Life expectancy: Impact of HIV and AIDS (Years)*
	2005	*2005*	*2005*	*2005*	*2005*	*2005*	*2005*
South Asian countries							
Bangladesh	0.01	7.5	0.01	1.67	0.00	64.1	–0.02
India	0.38	7.9	0.22	1.49	–0.02	65.5	–0.5
Nepal	0.5	7.7	0.30	1.97	–0.03	63.8	–0.7
Pakistan	0.1	7.1	0.07	1.84	–0.01	65.5	–0.2
Sri Lanka	0.03	7.2	0.02	0.47	–0.01	72.4	–0.1
East Asian countries							
Cambodia	1.06	8.4	0.59	1.74	–0.13	59.7	–0.8
China	0.08	7.1	0.03	0.58	0.00	73.0	–0.1
Thailand	1.46	8.5	0.63	0.66	–0.05	70.6	–1.1
Myanmar	0.76	9.7	0.53	0.85	–0.05	62.1	–0.6

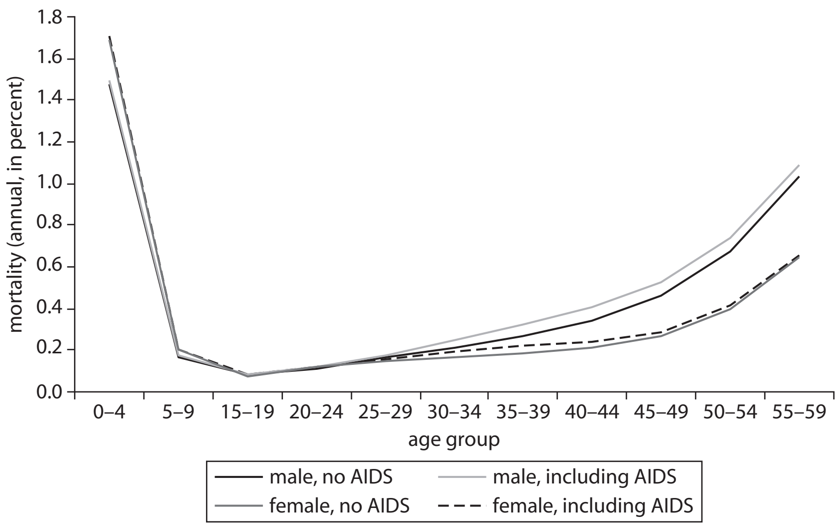
Sources: UNAIDS/WHO (2008) for HIV prevalence, UN Population Division (2007) for population indicators, author's estimates, based on data from UN Population Division (2007) and other sources, for HIV and AIDS-related indicators.

expectancy declined by around one year, and up to 1 in 11 deaths was accounted for by HIV and AIDS.

One of the characteristic features of the HIV and AIDS epidemic is that the majority of those infected are young adults; therefore mortality is also concentrated at relatively young ages. Figure 3.2, based on estimates by the UN Population Division (modified to account for lower estimates of HIV prevalence) shows that HIV and AIDS do have a notable impact on mortality, especially at ages 30–44. As the majority (about 70 percent) of people living with HIV and AIDS in India are male, the impact on mortality is much more pronounced for this group. Between the ages 25 and 40, mortality increases by 20 percent for males, and 14 percent for females. Consequently, the probability of reaching age 50 declines by 1.5 percentage points for men, and by 0.6 percentage points for women. Another consequence of the age structure of people living with HIV and AIDS is that people dying for AIDS-related reasons frequently leave behind dependents, including orphans.

Obviously, the demographic projections, especially the impact of HIV and AIDS on the age profile of mortality, depend on the coverage rate of antiretroviral treatment in the respective country (a point that we will return to below). The UN Population Division incorporates estimates

Figure 3.2 India: HIV/AIDS and Mortality by Age and Sex

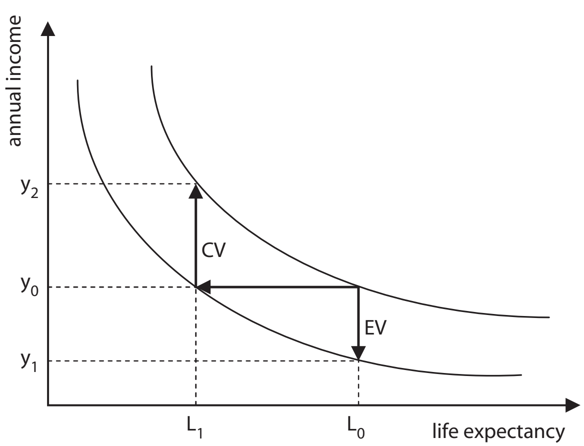


Source: Author's calculations.

of the coverage rate of antiretroviral treatment in their demographic projections, in line with WHO (2006). According to those estimates, access to antiretroviral treatment in India was limited in 2005 (about 7 percent), and therefore had limited impact on the estimated mortality rates shown in figure 3.3 below. However, the more recent estimates of the scale of the epidemic suggest that the coverage rates achieved in India were higher, around 15 percent to 20 percent.[3] Nevertheless, even with complete coverage of antiretroviral treatment, figure 3.3 would still show a significant increase in mortality among young adults, as the UN Population Division assumed that the median and average survival times of adults after initiation of treatment are 6.6 years and 9.5 years, respectively.[4]

While the most readily available estimates of the demographic impacts of HIV and AIDS presented here provide some indicators for the average impact of HIV and AIDS on the population, they fall short from an economic perspective as they do not capture the socioeconomic profile of the epidemic. Most important, the available evidence suggests that the most important drivers of the HIV epidemic in South Asia are injecting drug use and sex work (see the discussion by Claeson and Wilson, this volume). These findings, however, do not easily translate into socioeconomic categories commonly used in analyzing distributional aspects of health developments.

Figure 3.3 Evaluating the Loss from Reduced Life Expectancy



Source: Author's calculation.

The Economic Impact of HIV and AIDS: Aggregate Approaches

The scale of the demographic impact of HIV and AIDS in some regions has motivated studies of the actual or potential economic impact of HIV and AIDS, most of which discuss the effects on economic growth, GDP, or GDP per capita. While the earlier studies employed a neoclassical growth framework to derive estimates of the growth impact of HIV and AIDS from its direct impacts on (physical and, sometimes, human) capital accumulation and the demographic implications, some more recent studies also consider longer-run effects, for example, through access to and decisions on education. A somewhat different approach is based on the premise that the most direct and severe impact of HIV and AIDS on welfare arises from the increased risk to health and life associated with it. Accordingly, some studies attempt to quantify the welfare losses caused by increased mortality and deteriorated health. Finally, in a context of increasing access to treatment, it is also important to consider the repercussions of access to treatment for the economic impact.

Economic Growth

Many studies of the impact of HIV and AIDS on economic growth employ a neoclassical growth model in which HIV and AIDS affect parameters or factors of production that enter an aggregate production function.[5] To capture the essence of these earlier studies, and as a reference point for a discussion of some more recent efforts to calibrate the macroeconomic impact of HIV and AIDS, we briefly present a simple version as a "workhorse." We distinguish two production factors, capital K and labor L, and two productivity parameters, A (total factor productivity) and h, which is a measure of the average level of human capital and affects the productivity of labor. Thus, $Y = AK^{\alpha}(hL)^{(1-\alpha)}$. To obtain GDP per capita, it is necessary to divide Y by the size of the total population P, which yields

$$y = A(hl)^{(1-\alpha)}k^{\alpha}, \tag{1}$$

where $y = Y/P$ stands for GDP per capita, $k = K/P$, and $l = L/P$. In equilibrium,

$$y = A^{1/(1-\alpha)}hl\left(s/(\delta + n)\right)^{\alpha/(1-\alpha)}. \tag{2}$$

In this framework, HIV and AIDS has a level effect on steady-state GDP per capita, which can be attributed to changes in total factor productivity A, labor productivity or human capital h, the labor force participation rate l, the savings rate s, and the population growth rate n (assuming that the parameters α and the depreciation rate δ remain constant).

What are the implications of HIV and AIDS for GDP per capita in this framework? As an example, we illustrate the predicted effects for India, assuming an HIV prevalence rate of 0.36 percent, and setting the parameters α and δ equal to 0.35 and 0.08, respectively. Haacker (2004b) summarizes some of the most commonly quoted productivity effects, suggesting that an HIV prevalence of 20 percent would be consistent with a productivity loss of 2 percent to 3 percent; for India, the implied loss in GDP per capita through this channel would be about 0.08 percent.[6] Changes in labor force participation would reflect both people living with HIV and AIDS withdrawing from the labor market, and demographic shifts (specifically, a change in the share of the working-age population in the total population). Regarding the former, assuming that 5 percent of people living with HIV and AIDS withdraw from the labor market appears to be on the high side, this would translate into a decline in l by 0.02 percent. Regarding the role of induced demographic shifts, we use data from the UN Population Division (2007), suggesting that the impact at present is minimal (0.02 percent), but that it will rise to around 0.1 percent by 2020. Overall, the impact of HIV and AIDS on l would amount to 0.05 percent in 2005, but may rise to about 0.1 percent by 2020.

The potential impact of HIV and AIDS on savings and investment is more difficult to establish, and we consider the following as a plausible guess for the purpose of our numerical exercise. From microeconomic studies, we note that households affected by HIV and AIDS tend to dissave to finance treatment and care. This, however, applies less to wealthy households, which carry a disproportionate weight in national savings. Somewhat arbitrarily, we assume that national savings decline by 0.1 percent (corresponding to 0.03 percentage points, given a savings rate of about 30 percent). Finally, based on estimates by the UN Population Division (2007), we assume that population growth slows from 1.51 percent to 1.49 percent (for 2005–10), which would raise GDP per capita by about 0.1 percent.

Overall, the impact of HIV and AIDS on steady-state GDP per capita in India, through the direct effects described, appears to be very small. Adding up the various channels, we arrive at an overall negative impact of 0.16 percent, owing to the productivity effect (–0.12 percent), the decline in the share of the working-age population (–0.10 percent), and a decline in savings (–0.05 percent), partly offset by the slowdown in population growth (+0.12 percent). To understand the magnitude of this effect, it is instructive to relate it to the annual rate of growth of GDP per capita (about 6 percent annually in 2001–06). A decline in the level of steady-state GDP per capita of 0.16 percent thus corresponds to a one-off loss of about 1.5 weeks of GDP growth. This would be barely perceptible, especially as the adjustment to the new steady-state level of GDP per capita would take several years, so that the slowdown in growth would be spread accordingly.

While focusing on the impacts of HIV and AIDS on the level and growth of GDP per capita above, it is also important to understand the impact on long-term GDP growth. For this, it is convenient to think of GDP as the product of GDP per capita and the size of the population. Regarding GDP per capita, the most concrete effects of HIV and AIDS on GDP we describe relate to the level, but not the rate of growth, of GDP per capita. The key channel through which HIV and AIDS affects GDP growth in our preliminary analysis is the rate of population growth, which in India slows down by about 0.02 percentage points in 2005–15, after which the negative impact gradually tapers off through 2050 (according to the UN Population Division 2007). Overall, the level of the population is projected to be 0.5 percent lower than in the absence of HIV and AIDS by 2050 (a small change relative to the projected increase of 44 percent between 2006 and 2050). Assuming an average GDP growth rate of 5 percent over this period, the slowdown in GDP growth owing to an HIV and AIDS-related slowdown in population growth would thus be relatively modest, corresponding to the loss of about one-200th of the average growth rate attained through 2050.[7]

Two aspects of the impact of HIV and AIDS on growth could result in a somewhat more adverse outcome than the one described above. First, if reduced expectations of economic growth or higher production costs result in a decline in investment, this could exacerbate the impact on growth. We have not modeled this channel, as HIV and AIDS are not normally rated among key factors affecting growth prospects or production costs in South Asia,[8] and apparently do not factor into investment decisions in the region. Second, HIV and AIDS may affect the rate of accumulation of human capital, including through impaired access to education (both formal and within the family) for an increasing number of orphans. While we do provide some evidence that access to education may be an issue, we cannot adequately quantify the implications for economic growth without better knowledge about the impact of HIV and AIDS on orphans, the socioeconomic profile of the epidemic, and the consequences of orphanhood in the region.

On the other hand, aggregate economic models of the type used here may overestimate the impact of an epidemic on economic growth if the distributional aspects of the epidemic matter. There are two factors that may suggest that the growth impacts of HIV and AIDS are lower than the model above suggests. To the extent that the contribution of high-risk population groups—notably injecting drug users and sex workers—to GDP is below average GDP per capita, and if the epidemic is concentrated among these groups, an aggregate model such as the one employed here may overstate the impact on GDP.[9] A second factor not captured here regards access to treatment. If the economically most active segments of the populations have privileged access to treatment, the impacts of HIV and AIDS on GDP growth could be milder than suggested by aggregate demographic indicators (while poverty outcomes could be worse). The limited access to treatment in South Asia so far (table 3.8), and the important role of private out-of-pocket spending in the health systems of most South Asian countries (see Over, this volume), suggests that this is a relevant consideration.

Welfare

While the scale of the impact of HIV and AIDS on GDP or GDP per capita is important for many reasons, observers agree that the adverse impact of HIV and AIDS is not adequately described by these measures. There are two main approaches to developing more substantial (in the sense of providing policy guidance) measures of the economic impacts of HIV and AIDS. One line of reasoning emphasizes the distributional aspects of HIV and AIDS, which arise if the risk of infection, the ability to cope with the economic impact, and the access to care and treatment are correlated with income or other poverty-related indicators. These issues are at the heart of many of the policy issues regarding the response to HIV and AIDS, and are discussed in more detail further below. A second approach, which we now turn to, focuses on the direct implications of HIV and AIDS on health and mortality, and attempts to estimate the economic costs of risks to health and life. The logic behind this approach (and its relation to the estimates of the impact on GDP per capita, above) can be summarized by an equation describing an individual's welfare over his or her lifetime, depending on consumption, the state of health, and expected survival rates, for example:

$$W_t = h_t u(c_t) + E\left[\sum_{i=t+1}^{T} S_{ti} D_{ti} h_i u(c_i)\right]. \quad (3)$$

This individual's well-being in period t, $h_t u(c_t)$ depends on consumption in that period (c_t) and an indicator of the individual's state of health (h_t). The individual's lifetime welfare also includes expectations ($E[\ldots]$) about well-being in future periods, taking into account a possible discount factor (D_{ti}, – frequently, it is assumed that $D_{ti} = e^{-\gamma(i-t)}$) and the probability to survive from period t to period i, S_{ti}.[10]

An individual whose welfare is described by Eq. (3) values a high income (which translates into high consumption) and longevity. When analyzing the welfare impact of an epidemic, which brings about a decline in survival rates, Eq. (3) can therefore be used to calculate the income loss that, at survival rates prior to the adverse health event, would have yielded the same welfare loss as the observed increase in mortality, given income. As this hypothetical change in income describes an income loss *equivalent* to the observed increase in mortality, it is referred to in the microeconomic literature as *equivalent variation*.

This reasoning is illustrated in figure 3.3. The indifference curves describe combinations of life expectancy and annual income that yield the same welfare level. An adverse health event results in a decline in life expectancy from L_0 to L_1. For a given life expectancy of L_0, a drop in income from y_0 to y_1 would yield the same decline in welfare; this is the equivalent variation referred to above (labeled EV in figure 3.3), and will be used as a measure of the welfare costs of HIV and AIDS in our analysis. A different measure of the costs of HIV and AIDS that is sometimes presented is the amount that would, at the lower level of life expectancy L_1, restore welfare to the initial level. This is also referred to as compensating variation (labeled CV in figure 3.3).[11]

The shape of the curves in figure 3.3, and thus the size of the equivalent income loss, depends on the curvature of the function u(c) in Eq. (3). The faster the marginal utility of c declines, the steeper is the indifference, and the higher is the income loss that is equivalent to a given decline in life expectancy.

The approach sketched here had originally been used to estimate the contribution of improving life expectancy to living standards. It had first been applied to illustrate the welfare effects of HIV and AIDS by Jamison, Sachs, and Wang (2001); Crafts and Haacker (2002, 2004) present a more fully developed framework; more recently, Philipson and Soares (2005) confirm the earlier findings; and Das and others (2006) apply a similar framework to India, but focus on morbidity rather than the risk of premature death. To estimate the welfare costs of increasing mortality in South Asia, we follow Crafts and Haacker, who postulate that a 1 percent decline in life expectancy, in terms of its welfare effects, is equivalent to a loss in income of 3.68 percent.[12]

Drawing on the estimates of the impacts of HIV and AIDS on life expectancy discussed earlier, it is then possible to estimate the welfare impacts of HIV and AIDS owing to higher mortality. Table 3.3 presents these estimates for the five South Asian countries for which point estimates of HIV prevalence are available. For India and Nepal, the countries with the highest HIV prevalence rates in the region, the impact of HIV and AIDS on living standards is substantial (minus 4 percent and minus 3 percent, respectively), owing to the declines in life expectancy. We thus find that the welfare costs associated with higher mortality (or lower life expectancy) are much higher than the impact of HIV and AIDS on economic growth discussed above. Our framework also allows comparisons of the costs of HIV and AIDS with the rate of growth of GDP per capita. In India, an economy growing very fast in international comparisons (with annual growth of GDP per capita of about 6 percent), the costs of HIV and AIDS correspond to about half a year of economic growth. While the impact of HIV and AIDS in Nepal is lower, so is GDP growth, and the costs of HIV and AIDS exceed the annual gains in GDP per capita (3 percent annually in 1996–2006).[13]

These estimates are also useful as illustrations of the macroeconomic risks associated with HIV and AIDS, implying that a rise in HIV prevalence to 1 percent could wipe out the equivalent of one to two years of economic development. Thus, failure to contain the epidemic at low levels does have serious economic consequences, even if one considers prevalence rates of 1 percent to 2 percent (as observed in some other Asian countries) as a worst-case scenario.

Table 3.3 South Asia: Welfare Effects of Reduced Life Expectancy, 2005

	HIV prevalence, age 15–49 (percent)	*Life expectancy (years)*	*Impact of HIV /AIDS (years)*	*Welfare effects of HIV/AIDS (percent)*
Bangladesh	0.01	64.1	–0.02	–0.1
India	0.38	64.7	–0.5	–2.8
Nepal	0.5	63.8	–0.7	–4.0
Pakistan	0.1	65.5	–0.2	–0.9
Sri Lanka	0.03	72.4	–0.1	–0.3

Sources: UNAIDS and WHO (2008), UN Population Division (2007), and author's estimates and calculations.

Summary of Findings

There are two main findings we draw from our discussion of the aggregate effects of HIV. First, the welfare effects, in the specific sense of the cost of increased mortality, are by no means small, corresponding to the equivalent of one-half to one year of economic growth in India and Nepal. In an adverse scenario, which has HIV prevalence rising to 1 percent, the welfare costs could rise to the equivalent of one to two years of economic growth. Second, most of the welfare costs are associated with the direct health impact of HIV (we focus on mortality), whereas the impact on economic growth or income per capita appears minor in South Asia. This finding is important as it means that the response to HIV and AIDS will not be complicated by any macroeconomic repercussions.

However, in terms of understanding the impact of the epidemic on society, designing policies to address the impact, and implementing the response to HIV and AIDS, the broad measures of the size of the impact carry little information. To this end, it is important to gain a better understanding of who is affected by the epidemic. Further, we need to understand how the epidemic affects key development goals (for example, in the areas of poverty reduction, education, and gender, in addition to the direct health impact); we will turn to this issue next.

Beyond Aggregate Measures of the Impact of HIV and AIDS

As noted above, much of the economic development impact of HIV and AIDS cannot be captured by the aggregate measures presented above. First, the impact is uneven. The impacts are concentrated in and can be very severe for the households directly affected by HIV and AIDS. This is a situation, in terms of welfare effects or policy implications, very different from a setting in which the adverse impacts are distributed evenly. Second, the ability of households to cope with the economic impact of illness (for example, regarding the costs of care and treatment or the need to compensate for the loss of a breadwinner) differs according to socioeconomic status. Third, HIV and AIDS particularly affect certain population groups (for example, orphans); also, a low economic status of women can translate into increased vulnerabilities regarding the risk of infection or the economic consequences of infection or widowhood. Finally, access to prevention and treatment may differ across population groups. While this is an issue that is clearly relevant here, we take it up later in the context of our discussion of the response to HIV and AIDS.

Impact and Coping

Our analysis proceeds in two steps. First, we discuss some of the direct impacts, focusing on household income, health, and stigma. Second, we address how households cope with the demands associated with an HIV infection, looking at caregiving, increased medical expenditures, and the financing of any additional household needs (or of income shortfalls associated with HIV and AIDS). Owing to data limitations, most of our discussion in this section draws on two studies of the household-level impacts of HIV and AIDS in India (Das and others 2006, and Pradhan and others 2006), with some additional pieces of information added, where available. Two key aspects of the impact of HIV and AIDS—the implications of orphanhood and access to treatment, are treated in dedicated sections below.

HIV and AIDS can be associated with *employment loss or reduced income* as people living with HIV and AIDS (or caregiving household members) have to take time off from paid employment. Both Pradhan and others (2006) and Das and others (2006) find that unemployment rates among people living with HIV and AIDS are higher than for the respective control groups. The former report an unemployment rate for HIV-positive men of 14.2 percent (non-HIV positive: 4.3 percent) and for women of 4.5 percent (non-HIV positive: 2.9 percent); the latter finds an unemployment rate among males living with HIV and AIDS of 13 percent (non-HIV positive: 5 percent). For women, Das and others (2006) find that some HIV-positive women enter employment; many of these are widows whose household has lost an income earner.

The most detailed data on employment loss associated with HIV and AIDS are those of Pradhan and others (2006), who find that 36.5 percent of people living with HIV and AIDS who were able to retain their employment nevertheless reported an income loss, which averaged about 9 percent. Among those who lost their employment (about 9 percent of the sample of people living with HIV and AIDS), the income loss was severe, at about 66 percent. In rural areas, the reported income losses were somewhat higher (75 percent, compared with 60 percent in urban areas). Additionally, households may lose the income of caregivers; however, the average loss in income of caregivers is relatively modest (3.5 percent), and caregivers had to give up employment in only 0.5 percent of the surveyed households affected by HIV and AIDS).

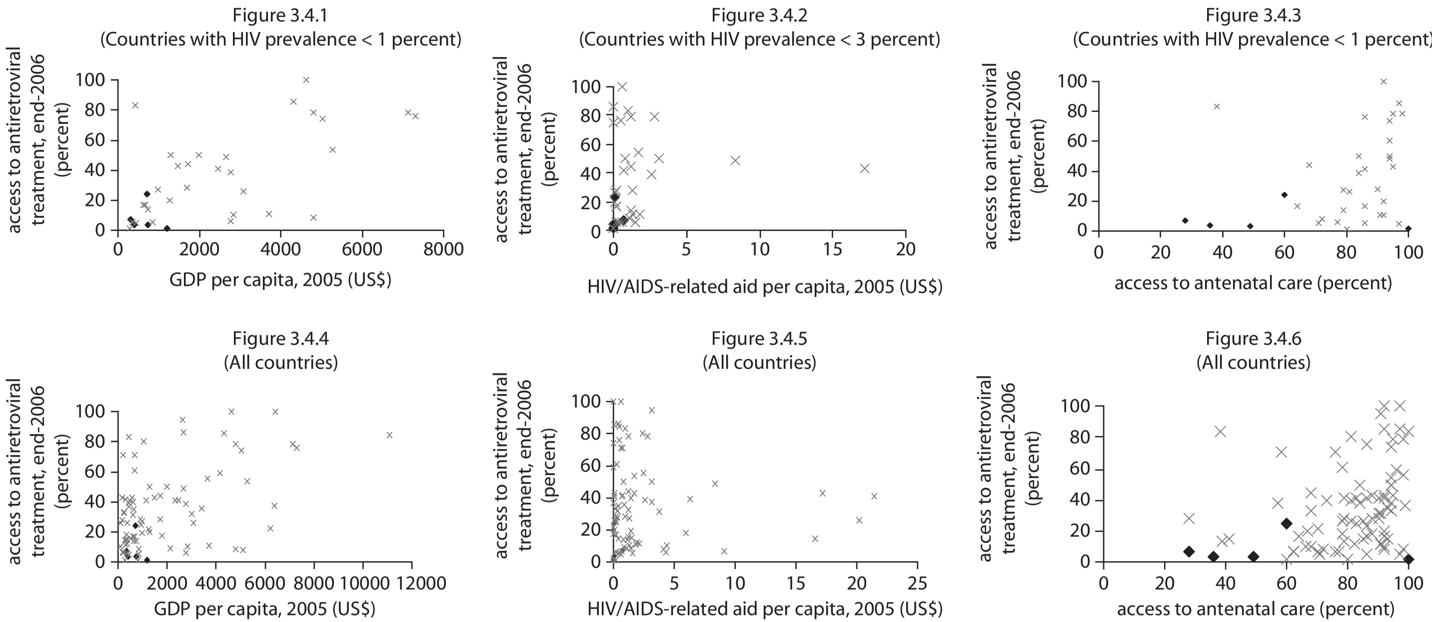
Another important aspect of the adverse income effects is the losses associated with the death of a person living with HIV and AIDS. One area where such losses are particularly pervasive is the situation of

HIV-positive widows. As noted in Pradhan and others (2006), widows account for a substantial share of women living with HIV and AIDS; this study also reports that about half of the households headed by widows have an annual income of less than Rs. 20,000, compared to about one-sixth of other households affected by HIV and AIDS, and 10 percent of the households not affected by HIV and AIDS. However, as this study does not provide more information on the composition of households headed by widows, it is difficult to interpret these findings. Das and others (2006) report much lower income for households headed by widows compared to households with widowers.

The *medical aspects* of HIV and AIDS are largely beyond the scope of the present study. In an economic development context, Das and others (2006) provide some indicators of the negative impact of HIV on health indicators such as the body mass index or an index intended to measure the extent of morbidity, and also discuss indicators based on subjective well-being, and provide estimates of the welfare costs of such declines in the heath of affected individuals, based on a compensating variation (see figure 3.4 on a similar example of the concept, in the context of our discussion of the welfare implications of increased mortality). Pradhan and others (2006) report data on the incidence of episodes of illness and the types of illnesses affecting people living with HIV and AIDS in their sample.

An additional component of the adverse effects of HIV and AIDS is the *stigma* associated with it, and both Das and others (2006) and Pradhan and others (2006) provide some evidence for its relevance for assessing the impacts of HIV and AIDS on affected individuals and households. According to Pradhan and others (2006), about 10 percent of respondents living with HIV and AIDS reported being "treated differently or badly." Among these, the most common forms of stigma are neglect and isolation (about two-thirds), verbal abuse, children's isolation, or being socially excluded (about one-third each, multiple responses possible). About 2 percent of respondents were asked to vacate their house because of their HIV status. Regarding discrimination at the workplace, only about one-quarter of respondents disclosed their HIV status there, and about 40 percent of these reported some form of stigmatization (most commonly denial of promotion, refusal of loan, isolation, or name calling). Among those who did not disclose their HIV status at the workplace (three-quarters of respondents), concern about losing their job played an important role. Similarly, Das and others report for their sample that about three-quarters of people living with HIV and AIDS did not disclose their HIV status to family and friends, and 85 percent did

Figure 3.4 Access to Treatment and Key Development Indicators



Sources: IMF (2007), OECD (2007), and WHO, UNAIDS, and UNICEF (2007).
Note: Data points relating to South Asian countries are shown in bold.

not disclose it at the workplace, out of concerns about negative consequences for themselves or their family.

While it is clear from our discussion of the income effects of HIV and AIDS that many households experience shortfalls in income, which in some cases can be very significant, HIV and AIDS is also associated with an increased demand for health services, and increased household expenditures on care and treatment. According to Pradhan and others (2006), medical expenditures account for 11 percent of total expenditure of HIV and AIDS-affected households, as compared with 3 percent for households not affected by HIV and AIDS. This comparison, however, understates the impact of HIV and AIDS as households affected by HIV and AIDS increase their total expenditure as well. When measured against expenditure of the non-HIV and AIDS control group, the increase therefore comes out somewhat more pronounced (9.4 percent rather than 8 percent). The findings by Das and others (2006) are broadly in line with these findings.

Regarding medical expenditures, one key aspect is the financing of antiretroviral treatment, and Pradhan and others (2006) provide some data on different channels of access to ART and the associated costs. More than half of the respondents with access to antiretroviral treatment (about 15 percent of the respondents living with HIV and AIDS) receive it at government hospitals, and an additional 5 percent through NGOs. With monthly costs of antiretroviral treatment through private providers between Rs. 1,141 (through chemist shops) and Rs. 1,669 (through private nursing homes or doctors), and the latter exceeding total monthly household expenditure for many households affected by HIV and AIDS, government facilities (Rs. 246) and NGOs (Rs. 547) clearly are the only modes of provision of antiretroviral treatment accessible to a large share of people living with HIV and AIDS. Also, it is important to bear in mind that—reflecting that only 15 percent of people living with HIV and AIDS among the respondents receive treatment—the reported increases in medical expenditures largely reflect the pre-ART stage of HIV and AIDS, and likely understate the eventual impact of HIV and AIDS on medical expenditures.

As incomes shrink while the need for expenditures on care and treatment increases, households affected by HIV and AIDS frequently borrow or dissave by selling off or drawing down household assets. Pradhan and others (2006) observe that 46 percent of households affected by HIV and AIDS borrow, but only 27 percent in the control group, with a modestly higher average borrowing. Among households that borrowed, the amount borrowed was higher for households affected by HIV and AIDS (Rs. 10,992, as compared with Rs. 9,167 for households not affected by HIV and AIDS). Regarding savings, their data illustrate the asymmetric economic impact of HIV and AIDS according to income category, specifically the adverse impact of HIV and AIDS for the two lowest income categories for which they report data. For income between Rs. 20,001 and Rs. 30,000, the savings rate declines by about 10 percentage points; for lower-income households, the decline in the savings rate is about 24 percent (table 3.4).[14]

Orphans

Beyond those infected, one population group that is seriously affected by HIV and AIDS is children of people living in HIV and AIDS-affected households and orphans. While there is little information regarding the specific situation of children orphaned by AIDS, especially in countries with low HIV prevalence rates (all countries in South Asia), we can also draw some relevant information from studies analyzing the situation of children orphaned by AIDS in general. However, one issue that is particularly relevant for AIDS orphans is the high rate of children who have lost both parents in this group, reflecting high rates of coinfection among couples, which tends to exacerbate the adverse impacts of orphanhood.

The situation of children orphaned by AIDS has been recognized as a core challenge in the context of the international response to HIV and AIDS (see for example, UNAIDS/WHO 2006a). However, estimates of the impact of HIV and AIDS on orphan rates are not available for South Asian countries. To obtain a best available estimate of the impact of HIV and AIDS on orphan rates, we therefore have to draw on evidence from other countries, or draw some inferences from other demographic indicators such as mortality rates.

Table 3.4 Household Savings by Income Category

	Non-HIV Households		*Households Affected by HIV*	
Household income category	*Household savings (Rs)*	*Savings rate (%)*	*Household savings (Rs)*	*Savings rate (%)*
Up to 20,000	–51	–0.3	–3,197	–23.4
20,001–30,000	361	1.4	–2,087	–8.3
30,001–41,000	1693	4.8	–358	–1.0
41,001–84,000	5906	10.2	2637	4.6
84,001 and above	26,801	21.3	35,123	24.7

Source: Pradhan and others 2006.

Regarding cross-country evidence, a number of countries in southern Africa,[15] before the arrival of HIV and AIDS, had similar mortality profiles as the countries in South Asia we focus on, and estimates of the impact of HIV and AIDS on orphan rates are available for these countries. For these countries, an HIV prevalence rate of 20 percent could translate into a share of orphans among the young population (ages 0–17) of more than 10 percent. For countries like India or Nepal (HIV prevalence 0.4 to 0.5 percent), this would translate into an increase in orphan rates of 0.2–0.3 percentage points, which compares to an underlying orphan rate of about 9 percent.

However, there are two principal shortcomings to this comparison. First, the increase in orphan rates in southern Africa does not show the full impact yet, as mortality among working-age adults has been increasing over the last decade. More substantially, even if one accepts that the demographics of the respective countries (in South Asia vs. southern Africa) allow this kind of comparison, the nature of the epidemic differs very significantly between the regions, with important implications for the link between increasing adult mortality and orphan rates. Most important, and reflecting differences in risk behavior, HIV prevalence among women is much lower than for men (as evident from the low share of women among people living with HIV and AIDS; see table 3.1). Additionally, adverse health conditions may affect fertility, and—especially for men—certain types of risk behavior (men having unprotected sex with men, injecting drug use) may be negatively correlated with the propensity to procreate. In order to estimate the number of orphans, it is also necessary to account for the number of children who have lost both parents.

Specifically, we make the following assumptions: (1) We calculate the (increased) likelihood of becoming a maternal orphan by age, based on the average increase in mortality among females at age 20–49. (2) We calculate the likelihood of becoming a paternal orphan, but cap the increase in parental mortality at twice the increase in maternal mortality.[16] (3) To estimate the total number of orphans by age, we add up maternal and paternal orphans, adjusting for an assumed share of children who have lost both parents among AIDS orphans of one-quarter.[17] (4) To calculate the increase in the share of orphans among the young population (ages 0–17), we apply weights to each year, in line with the rate of population growth. (5) Finally, we subtract 10 percent from the total to account for higher mortality among children who have contracted HIV from their mother.

In this scenario, we find that HIV and AIDS could result in an increase in the number of orphans of about 0.4 percent of the young population in India. By age 17, about 0.9 percent of the young population will have experienced orphanhood owing to HIV and AIDS. The estimates for Nepal are similar; while estimated HIV prevalence is higher, the share of women among people living with HIV and AIDS is lower, and higher population growth also mitigates the increase in the orphan rate.

Besides income effects, another dimension of increased risk on the individual level is the increased risk of orphanhood and its implications for individual welfare at a young age and beyond. In addition to the direct effects of losing a parent, orphanhood can have numerous economic repercussions. One immediate concern is that orphanhood may be associated with a deterioration in material living standards during childhood if orphans live in poorer households. For paternal orphans, Ainsworth and Filmer (2006), in one of the few studies covering Asia and not only Sub-Saharan Africa, find that in about two-thirds of the surveys covered by their study, orphans are concentrated in poorer households. Maternal orphans also tend to live in poorer countries, while there is considerable variation across countries. The greatest variation occurs for two-parent orphans, who frequently live in richer households. However, they note that the countries with the highest concentration of two-parent orphans among the poor are Asian (Laos, Indonesia, and the Philippines).

The second main channel that has been studied relatively widely through which orphanhood can affect living standards is access to education. Table 3.5 reports the findings from Ainsworth and Filmer (2006) on enrollment rates for orphans and nonorphans. At least for the first four studies shown, orphanhood is associated with substantially lower enrollment rates, with a difference between enrollment rates for nonorphans and two-parent orphans between 9 percent and 27 percent, and paternal or maternal orphans somewhere in between.[18] The literature points at various reasons for the apparent link between orphanhood and educational status or attainment. While enrollment rates are usually correlated with household income, the link between orphanhood and household income is not clear in many countries (see above). Other factors that could have a bearing on orphan rates include the degree to which the household head and an orphan living in the household are related,[19] or the nonmonetary aspects of the relationship between parents and children.[20]

Table 3.5 Access of Orphans to Education, Six Countries

	Sample size (Number of 7- to 14-year-olds)	Households with at least one orphan (Percent)	Enrollment rate of 7- to14-year-olds by orphan status (Percent)			
			Parents alive	*Paternal orphan*	*Maternal orphan*	*Two-parent orphan*
Cambodia (2000)	16,437	8.1	77.4	71.9	64.2	58.5
Indonesia (1997)	29,513	n.a.	90.5	87.1	80.3	80.9
Indonesia (2002)	24,991	2.5	92.4	85.4	87.9	82.3
Lao PDR (2000)	8,953	4.5	74.6	64.7	65.6	48.0
Mongolia (2000)	5,327	4.8	71.2	73.6	70.6	87.5
Philippines (1999)	6,856	4.1	83.6	79.1	79.2	81.8
Vietnam (2000)	7,434	2.6	90.9	86.0	75.8	71.4

Source: Ainsworth and Filmer 2006.
Note: For orphans' enrollment rates, italics indicate that enrollment rates are not statistically significantly different from the nonorphan rate at the 5 percent level.

Table 3.5 also illustrates some of the difficulties involved in analyzing the effects of orphanhood. Especially for two-parent orphans, the number of observations is relatively low. In Cambodia, about 1 percent of 7- to 14-year-olds covered were two-parent orphans. In other Asian countries, the proportion is (sometimes much) lower. As a consequence, the differences between orphans and nonorphans sometimes come out insignificant.[21]

Both of the key studies we draw on in this section also provide some information on the status of orphans in households affected by HIV and AIDS in India. Das and others (2006) report on school attendance among households affected by HIV and AIDS. They find that school attendance rates for children of widows or widowers living with HIV and AIDS are about 15 percentage points lower than for households not affected by HIV and AIDS. Additionally, schooling expenditures per child in widow-led households are about one-third lower than for widower-led households or households with both parents alive. Pradhan and others (2006) differentiate children by gender and household income category (table 3.6). Whereas enrollment rates are virtually the same for high-income households affected or not affected by HIV and AIDS, enrollment rates are 7–8 percentage points lower for the lowest income category. The table also provides some evidence regarding a differential impact by gender— for the income groups between Rs. 20,000 and Rs. 41,000, the decline in enrollment rates is more pronounced for girls.

Table 3.6 Enrollment Rates by Income Category, Ages 6–14
(Percent)

Household income category (Rs)	*Non-HIV households (%)*		*Households affected by HIV (%)*	
	Boys	*Girls*	*Boys*	*Girls*
Up to 20,000	87.0	85.4	94.0	93.2
20,001–30,000	92.5	86.3	93.7	93.0
30,001–41,000	93.2	85.9	96.7	94.7
41,001–84,000	92.8	92.3	97.0	95.6
84,001 and above	98.7	96.1	98.2	97.4

Source: Pradhan and others 2006.

Economic Development Aspects of the Response to HIV and AIDS

By reducing the scale of the epidemic and mitigating the impacts of HIV and AIDS, the international and national responses to HIV have implications for the economic development impact of HIV and AIDS. At the same time, information about the impacts of HIV and AIDS across population groups, as well as of measures to increase awareness, enhance prevention, improve access to treatment, and mitigate the economic and social consequences, can be used to refine the tools adopted to address the epidemic.

Whereas chapter 1 discusses the epidemiology of HIV and AIDS and the implications for effective prevention, we focus on awareness as one of the factors influencing access to prevention. Specifically, we look at differences in HIV awareness across population groups. Our discussion of the challenges of expanding access to treatment proceeds in three main steps. First, we take stock of progress made in expanding access to treatment. As coverage rates of antiretroviral treatment are relatively low in South Asia, we discuss some potential reasons for this. Second, looking forward, the projected fiscal costs of expanding access to treatment are substantial. A scenario assuming an escalation of the epidemic to an HIV prevalence rate of 1 percent of the population between the ages of 15 and 49 suggests that the demand for treatment would rise to an equivalent of between 10 percent and 35 percent of total health expenditures.[22] These findings accentuate the key role of effective prevention (mitigating the demand for HIV and AIDS-related health services) in scaling up treatment in a sustainable fashion. Third, while data on access to treatment across socioeconomic groups are scarce, we discuss some indirect evidence on access to treatment across population groups, looking at—among other factors—access to antenatal care.

Distributional Aspects on Access to Information about HIV

In addition to the ability to cope with the economic consequences of HIV and AIDS (discussed above) and access to treatment, knowledge and access to prevention services are key factors that affect an individual's or household's vulnerability to HIV and AIDS. As spending on prevention measures or other inputs to prevention programs cannot easily be attributed to individuals, an analysis of the socioeconomic dimension of access to prevention primarily relies on outputs to prevention programs, for example, changes in sexual and injecting risk behavior such as condom use and use of clean needles.

While not an ideal indicator in terms of measuring the success of prevention efforts (as it does not necessarily translate into behavior change), data on knowledge about the sexual transmission of HIV are interesting in the context of our discussion of the socioeconomic aspects of HIV and AIDS, as data on knowledge are available across certain socioeconomic categories and across countries. Lacking data on access to and use of prevention services or of behavior change by income, our discussion will therefore focus on knowledge about HIV across economic quintiles. Table 3.7 summarizes available data on knowledge about sexual transmission of HIV and AIDS for Bangladesh, India, and Nepal, and also reports data on knowledge about HIV prevention from the recently completed *2005–2006 National Family Health Survey* for India. We find a fairly regular pattern of HIV awareness by socioeconomic status across countries, with HIV awareness in the lowest wealth quintile only a fraction of the level of awareness in the highest quintile. Second, there are large differences between men and women, with average HIV awareness among women only about 50 percent to 60 percent of the level of awareness among men. Moreover, the "wealth gap" and the "gender gap" tend to reinforce each other—by far the lowest levels of awareness are recorded for women in the lowest wealth quintile; and the gap between the highest and lowest quintile is much higher for women. One possible explanation for these gaps is access to education. In the countries covered, the patterns of HIV awareness resemble data on school completion rates, and studies differentiating by years of schooling (such as International Institute for Population Science (IIPS) 2007; see lower panel of table 3.7) find a similar pattern by level of education.

To understand how differences in HIV awareness, risk behavior, and other factors translate into a socioeconomic profile of HIV and AIDS

Table 3.7 HIV Awareness across Population Groups
(Percent)

	Knowledge about sexual transmission of HIV							
		Wealth Quintile					*Urban*	*Rural*
	Average	*Lowest*	*2nd*	*3rd*	*4th*	*Highest*	*(Average)*	*(Average)*
Bangladesh (2004)								
Men	51.5	27.5	36.6	47.6	59.8	78.4	45.7	69.7
Women	31.6	9.7	17.0	26.4	40.2	64.2	25.7	51.7
India (1998/99)								
Women	25.3	4.6	8.7	19.3	33.6	59.6	62.8	48.5
Nepal (2001)								
Men	63.4	49.8	55.8	60.5	64.1	84.2	n.a.	n.a.
Women	28.9	10.9	19.1	23.8	33.6	59.6	64.3	49.5

	Knowledge that consistent condom use can reduce chance of acquiring HIV						
	Average	*No education*	*<8 years*	*8–9 years*	*>=10 years*	*Urban (Average)*	*Rural (Average)*
India (2006)							
Men	68.1	33.9	62.8	82.0	93.2	85.6	59.5
Women	34.7	12.5	34.9	57.6	81.0	56.3	25.1

Sources: Gwatkin and others 2007a, 2007b, and 2007c, and IIPS 2007.
Note: For Nepal (2001), the numbers included in Gwatkin and others (2007c) for rural vs. urban HIV awareness are inconsistent with the aggregates, as the average for both urban and rural HIV awareness is higher than the average for the aggregate.

across the population, we would ideally be able to draw on the results of population studies identifying households and individuals affected by HIV and AIDS and those not affected, and compare the respective groups. Hopefully, this will be possible for India when the full dataset of the *2005–2006 National Family Health Survey* is released. Until then, the main data sources are surveys that compare households affected by HIV and AIDS with unaffected households in the same area. While this approach is geared toward identifying household *impacts* of HIV and AIDS, it contains little information on the composition of the population living with HIV and AIDS, because the sample is confined to households that have been identified because they receive some HIV-related medical services, and thus are not representative of the entire population living with HIV and AIDS.

A few conclusions regarding susceptibility can nevertheless be drawn from these studies. For example, they illustrate the differences in risk behavior between men and women. While married men most commonly acquire HIV from other sexual partners, women frequently become infected by their husbands. In surveys of households affected by HIV and AIDS, this results in high rates of coinfection (both partners infected) and in high rates of HIV-positive widows, whereas the numbers of HIV-positive widowers is generally low. This is most likely explained by an infection pattern whereby the husband acquires HIV earlier and—in many cases—passes it on to the spouse. For example, Das and others (2006) report that "in 54 percent of the 'currently married' families affected by HIV and AIDS, both adults are infected with HIV, while in 42 percent of them only the male adult is infected, and in only 6 percent of cases only the female adult is infected," and that 76 percent of household heads who were "ever married" (largely widows and widowers) are female. Similarly, Pradhan (2006) finds that 36 percent of women living with HIV and AIDS are widowed, but only 4 percent of the men are widowers.

Another key dimension of differences in susceptibility to HIV and AIDS are groups engaging in high-risk behaviors, such as sex workers and their clients, men who have sex with men, and injecting drug users and their partners. While much of the literature regarding prevention strategies focuses on such vulnerable groups (see Wilson 2007), we have little information on the socioeconomic profile of these population groups, as they are not easily accessible using standard survey techniques. While they are some obvious linkages among HIV and AIDS, the propensity to engage in high-risk behavior, and development outcomes (most obviously for the link between prostitution and poverty), we unfortunately cannot provide an adequate discussion owing to data limitations.

The Challenge of Expanding Access to Treatment

Access to care and treatment has the potential to mitigate the health and economic impacts of HIV and AIDS. However, access to treatment is uneven across and within countries. To the extent that access to treatment is positively correlated with key development indicators, it may exacerbate inequalities in living standards. At the same time, expanding access to treatment represents a substantial logistical and financial challenge. With these basic considerations in mind, we will proceed along the following lines. First we discuss the current situation in terms of access to treatment, and the scale of the challenge of expanding treatment. While the data situation is very weak, we then provide some conjectures regarding the determinants of access to treatment within countries.

Table 3.8 summarizes the available data on access to treatment in South Asia. Generally, access to treatment is low in an international context.

Table 3.8 Access to Antiretroviral Treatment in South Asia

	HIV prevalence, end of 2007 (ages 15–49) (Percent)	*Estimated number of people requiring treatment, end of 2007*	*Estimated number of people receiving treatment, end of 2007*	*Antiretroviral treatment coverage, end of 2007 (Percent)*	*Antiretroviral treatment coverage, end of 2005 (Percent)*
Afghanistan	<0.01	n.a.	0	n.a.	n.a.
Bangladesh	0.01	2,400	170	7	1
Bhutan	0.09	<100	18	n.a.	n.a.
India	0.34	n.a.	158,000	n.a.	16
Maldives	n.a.	n.a.	1	n.a.	0
Nepal	0.5	20,000	1,400	7	1
Pakistan	0.10	20,000	600	3	2
Sri Lanka	0.03	780	107	14	6
Memorandum Items					
China	0.08	190,000	35,000	19	25
Thailand	1.4	250,000	153,000	61	60
Myanmar	0.7	76,000	11,000	15	7

Source: WHO (2006a); UNAIDS and WHO (2008); WHO, UNAIDS, and UNICEF (2006); and WHO, UNAIDS, and UNICEF (2008).
Note: The percent of people in India receiving ART comes from author's calculations, based on WHO, UNAIDS, and UNICEF (2006), making adjustments for subsequent revisions to estimated HIV prevalence.

WHO, UNAIDS, and UNICEF (2007) estimate that the coverage rate for low- and middle-income countries had risen to 28 percent as of the end of 2006; for Asia, they report an average coverage rate of 19 percent. If an adjustment is made for the revised estimates for India, the estimated coverage rate would rise to 31 percent globally and 33 percent for Asia. For most countries in South Asia, the coverage rates attained so far are much lower; only for India is the upper range of the estimates for treatment access in the vicinity of the global average. There are two sets of factors that may help explain the low rates of access to treatment in South Asia—limited economic or health sector capacities, and the composition of people in need of treatment.

In this regard, we explore several indicators for the capacities of South Asian economies, or their health sectors, to address the demand for increased health services associated with HIV and AIDS (figure 3.4). First, high levels of *GDP per capita* indicate both the availability of public financial resources to address increasing demand for health services associated with HIV and AIDS, but also a higher capacity among residents to privately pay for some of the costs of treatment, at least for part of the population. Second, a country's response to HIV may benefit from *external aid*, including for scaling up access to treatment. We therefore illustrate the correlation between HIV and AIDS-related aid and access to treatment. Third, we look at the link between access to treatment and *access to antenatal care* as an indicator for the coverage rate of basic health services. Finally, as the situation regarding constraints to scaling up may differ very significantly across high- and low-prevalence countries, we show the data for all countries where the data are available, and also for the subset of countries with an HIV prevalence rate lower than 1 percent.

Figure 3.4 illustrates the correlation of access to antiretroviral treatment with these development indicators. The data on access to treatment are based on the Progress Report by WHO, UNAIDS, and UNICEF (2007), and include all countries where point estimates on access to treatment were available (for South Asia: Bangladesh, Nepal, Pakistan, and Sri Lanka), plus India, where a point estimate for access to treatment was constructed from the midpoint estimates for people requiring and receiving treatment reported in table 3.8.

Our findings include the following:

- South Asian economies are among the economies with the lowest levels of GDP per capita among countries with low HIV prevalence, and also feature comparatively low rates of access to treatment within this group. However, GDP per capita is not a convincing determinant of a low level of access to treatment in South Asia, as many low-income countries with higher levels of HIV prevalence (in the full sample) feature rates of access that are much higher than those attained in South Asia.[23]

- There is no indication that differences in access to external aid may explain the relatively low levels of access to treatment in South Asia. For both the low-prevalence countries and the full sample, access to treatment in South Asia is comparatively low relative to countries receiving similar levels of external aid.

- Our data indicate that low access to treatment in South Asia is related to the low capacity of health systems in the region. Four of the South Asian countries are among the bottom five countries in terms of access to antenatal care for the low-prevalence sample, and they are among the bottom 10 countries for the full sample. Especially among the low-prevalence sample, access to treatment is positively correlated with the rate of access to antenatal care.

- However, the case of Sri Lanka, with a very high level of antenatal care, but an extremely low rate of access to treatment, amply illustrates that limited capacities of health services only partly explain the low levels of treatment in South Asia. At the same time, the example of Cambodia (with access to antenatal care of 38 percent, but access to treatment at 83 percent) shows that low capacities in basic health services need not be an insurmountable obstacle to attaining high coverage rates of antiretroviral treatment.

The findings from our discussion of the correlation between access to treatment and key development indicators are confirmed by an econometric analysis, based on the full sample.[24] Eq. (4) suggests that an increase in HIV prevalence of 1 percentage point translates into a treatment coverage rate that is lower by 1.1 percentage points, that a difference in GDP per capita of US$1,000 is associated with a difference in treatment access of 7 percentage points, that an additional US$1 in external aid per capita corresponds to a treatment access rate that is 2.9 percentage points higher; and a rate of access to antenatal care that is 1 percentage point higher translates into a treatment coverage rate that is 0.3 percentage points higher. As in our more informal discussion, the latter factor emerges as the most important one in terms of explaining differences in access to treatment in South Asia and other regions.

$$\begin{aligned} TREAT = & \underset{(-0.5)}{-6.0} - \underset{(-2.4)}{1.11}^{**} \cdot HIV + \underset{(6.9)}{0.007}^{***} \cdot GDPPC \\ & + \underset{(6.9)}{2.90}^{***} \cdot AIDPC + \underset{(2.2)}{0.3}^{**} \cdot ANCCARE, \qquad (4) \\ & \text{with } R^2 = 0.49.^{25} \end{aligned}$$

The Costs of Treatment

In light of the findings of the previous section, estimates of the costs of scaling up of antiretroviral treatment should be treated with caution, as scaling up takes place in the context of national health systems, and as the capacities of these systems in terms of financial resources, human resources, or the effectiveness of the health sector, may complicate the tasks of scaling up, or may pose constraints that cannot easily be overcome by additional financial resources only.

Nevertheless, estimates of the costs of scaling up provide important information relevant for planning national responses to HIV. Most directly, it is important for budgeting to know the financial implications of any given target for the coverage rate of antiretroviral treatment. Second, relating the required funding to overall health expenditure provides an additional indicator for the scale of the national response to HIV in the specific national context. Third, a comprehensive scaling up is normally associated with a sustained increase in the number of people requiring treatment (as survival rates for patients receiving treatment rise, while additional people living with HIV and AIDS reach the stage at which they also require treatment). To ensure the viability of the national treatment program in the future, it is therefore important to project the number of people who will participate in a treatment program or require treatment, and to ensure that the required resources (human, financial, drugs, and so on) are provided.

In line with international developments, the costs of treatment—most decisively, the prices of antiretroviral drugs—have fallen in Asia over the last years. Table 3.9 summarizes some of the latest available data. Allowing for some data collection and publication lag (the table quotes only recent studies published in 2006), these estimates suggest that the costs of antiretroviral treatment in low- and middle-income countries in Asia were around US$400–600 per year in 2004. To illustrate the progress made in improving the affordability of these drugs over the last years, in China, the costs were as high as US$10,000 in 2001 and US$4,000–5,000 in 2002.

To understand the full financial implications of expanded access to treatment, it is necessary also to account for the costs of administering the drugs and monitoring the treatment. More comprehensive cost estimates are available only for a subset of countries, suggesting an annual cost of around US$400. In the absence of estimates of the total costs of treatment

Table 3.9 The Costs of Antiretroviral Treatment
(Annual Costs, per Patient, in U.S. dollars)

	Costs of drugs	*Costs of monitoring, etc.*	*Total*
Cambodia	350	—	—
China	400	—	—
India	340	—	—
India	397	420	817
Indonesia	600	—	—
The Philippines	456–576	407	863–983

Sources: Morineau and others 2006 for Cambodia; Ma and others 2006 for China; Priya and others 2006 and Gupta, Trivedi, and Kandamuthan 2006 for India; Gunawan, Kosen, and Simms 2006 for Indonesia; and Monzon and Poblete 2006 for the Philippines.

for a wider set of countries, we will use this estimate throughout, using an indicative estimate of US$800 for the annual costs of treatment per patient across countries.[26] There are two principal uncertainties regarding this estimate. First, the prices of drugs or other supplies (for example, CD4 test kits) may fall, reducing the costs of treatment.[27] Second, drug resistance or other treatment failure may result in an increasing demand for more expensive ("second-line") drug combinations, especially as the number of patients who have been on antiretroviral treatment for some time increases. The average unit costs of treatment may therefore increase.

Based on these estimates, we provide three scenarios for the actual or potential costs of treatment (see table 3.10). *Scenario 1* represents an estimate of the current cost of treatment, based on the latest estimates of the numbers of people receiving treatment as of the end of 2006 (from WHO, UNAIDS, and UNICEF (2007)). *Scenario 2* presents the hypothetical costs of providing treatment to all people living with HIV and AIDS requiring treatment as of the end of 2006; that is, it corresponds to a coverage rate of treatment of 100 percent. Looking forward, one point that needs to be taken into account in estimating the potential costs of a comprehensive treatment program is that the number of people living with HIV and AIDS is endogenous (see Over 2004). Owing to reduced mortality and increased life expectancy, an expansion of treatment, controlling for other factors, is associated with an increase in the number of people living with HIV and AIDS and, even more pronounced, an increase in the number of people requiring treatment. For this reason, we report both estimates of the short-run costs (of providing treatment to all patients requiring it as of the end of 2006) and estimates of the longer-term costs.

Specifically, Scenario 2 makes the following assumptions: (1) It takes the number of people living with HIV and AIDS as given (as reported in table 3.1). (2) Regarding the immediate costs of a scenario with full access to treatment, it assumes that 20 percent of people living with HIV and AIDS require treatment.[28] (3) Regarding the longer term, it assumes that—as a consequence of a comprehensive treatment program—the number of people living with HIV and AIDS would rise by 80 percent, and that 60 percent of the people living with HIV and AIDS in this scenario receive treatment. The scenario is based on the assumption that life expectancy in the absence of treatment is 10 years after infection, that patients would require treatment after 7 years, and that treatment extends the lifespan by 8 years (that is, 11 years after initiation of treatment).[29]

Table 3.10 Expanding Access to Antiretroviral Treatment

				Costs of Treatment (Percent of GDP)				
					Scenario 2		*Scenario 3*	
	HIV prevalence, end of 2006 (ages 15–49, percent)	*GDP per capita, 2006 (US$)*	*Total health expenditure, 2004 (Percent of GDP)*	*Scenario 1 (impact)*	*(impact)*	*(longer term)*	*(impact)*	*(longer term)*
Bangladesh	0.014	451	3.1	0.0001	0.003	0.015	0.208	1.126
India	0.36	797	5.0	0.01	0.050	0.271	0.126	0.683
Nepal	0.5	339	5.6	0.004	0.135	0.728	0.280	1.512
Pakistan	0.11	830	2.2	0.0001	0.012	0.063	0.119	0.644
Sri Lanka	0.04	1,355	4.3	0.0002	0.003	0.017	0.082	0.445

Source: IMF (2007), UNAIDS (2006), WHO (2007), and author's estimates and projections.
Note: Estimates for Afghanistan, Bhutan, or Maldives are not shown, as point estimates of HIV prevalence are not available for these countries.

Scenario 3 is built in the same way as Scenario 2, but assumes that underlying HIV prevalence among the population between the ages of 15 and 49 rises to 1 percent in all countries (plus the increase in HIV prevalence owing to longer survival times because of improved access to treatment). Estimating what would represent a credible adverse scenario regarding the evolution of the HIV epidemic(s) in the region is beyond the scope of this paper; our "1 percent" scenario is motivated simply by providing a common indicator for the vulnerability of the respective countries' health sectors to an escalation of the epidemic, "normalizing" the estimates with respect to the level of HIV prevalence.

We find that the current costs of providing treatment to people living with HIV and AIDS are modest both from a fiscal perspective and relative to total health expenditures. Based on the numbers of patients receiving treatment as of the end of 2006, the costs were highest in India, at 0.01 percent of GDP, corresponding to 0.2 percent of total health expenditures. If treatment coverage were to rise to 100 percent, the costs of treatment in India would rise to 0.05 percent of GDP, and to 0.27 percent of GDP in the longer run (about 5 percent of total health expenditure). In Nepal, the country with the highest HIV prevalence rate and the lowest level of GDP per capita, the costs would be more substantial, eventually rising to 0.7 percent of GDP, and about 10 percent of total health expenditure. This analysis of the longer-term costs also accentuates the issue of sustainability of treatment programs, as the long-term costs come out about five times higher than at initiation of the program. Finally, Scenario 3 provides some indication of the implications of a hypothetical escalation of the epidemic(s) to a prevalence rate of 1 percent. In four countries (Bangladesh, Nepal, Pakistan, and Sri Lanka), the demand for treatment would exceed the equivalent of 5 percent of total health expenditure early on, and—in a comprehensive treatment scenario—would eventually rise to between 10 percent and 35 percent of total health expenditure.

Distributional Aspects of Access to Treatment

As we have argued above (in our discussion of socioeconomic impacts of HIV and AIDS), it is important to understand the impact of HIV and AIDS across population groups in order to fully grasp the development impact. This basic conjecture also applies to access to treatment, and our discussion here continues the earlier analysis of characteristics of households affected by HIV and AIDS and differences in the impact of HIV and AIDS across population groups. One principal obstacle to an analysis of the distributional aspects of access to antiretroviral treatment is lack of socioeconomic data on people receiving antiretroviral treatment. As a starting point, we therefore discuss socioeconomic differences in access to health services for which some cross-country data are available for South Asia (antenatal care visits to a medically trained person). Our discussion then closes with a review of some evidence regarding differences in access to treatment across population groups, focusing on differences by gender and access to treatment for injecting drug users (an important group among people living with HIV and AIDS in many South Asian countries).

Our choice of antenatal care visits to a medically trained person as an indicator for access to health services across population groups has been motivated by several considerations. One important aspect is data availability, as this is an indicator that has consistently been included in major health surveys across countries. Also, HIV and AIDS-related health services are typically delivered in larger health facilities rather than clinics catering only to people affected by HIV and AIDS. The data on antenatal care—as they carry some information on access to health facilities in general—may therefore provide a proxy for access to HIV and AIDS-related services. Antenatal care is also associated with antiretroviral treatment for prevention of mother-to-child transmission of HIV, and—though less directly—with access to antiretroviral treatment for adults, as tests at antenatal clinics may result in the detection of an infection. One primary shortcoming of this indicator, in the context of South Asia, is that antenatal care is utilized by women, whereas the majority of people living with HIV and AIDS are men. Table 3.11 summarizes data on antenatal care visits for Bangladesh, India, and Nepal.

We find a fairly regular pattern of antenatal care visits across countries. First, there are substantial differences in access across wealth quintiles. In this regard, India is the most equitable country, with access for the highest quintile about double the access for the lowest quintile, while the corresponding factor is higher than three for Bangladesh. Second, differences in the quality of services reinforce inequalities in overall access. While the wealthiest quintile predominantly draws on the services of a doctor, the poorer quintiles frequently (in the case of Nepal predominantly) only have access to a nurse or trained midwife. Third, controlling for wealth, there are gaps in access to services between the urban and rural populations, especially for the lower wealth quintiles.[30]

Another potential dimension of inequities in access to treatment regards differences by gender. While this is an important aspect of the socioeconomic impacts of HIV and AIDS, access to treatment seems to

Table 3.11 Antenatal Care Visits to a Medically Trained Person
(Percent)

		Wealth Quintile				
	Average	*Lowest*	*2nd*	*3rd*	*4th*	*Highest*
Bangladesh (2004)	48.8	24.9	38.6	48.8	60.6	81.1
to doctor	31.3	12.3	18.9	26.8	42.0	65.6
to nurse or trained midwife	17.5	12.6	19.7	22.0	18.6	15.5
Rural	43.0	24.1	37.0	46.7	59.3	74.2
Urban	71.0	33.9	52.9	62.0	66.7	85.7
India (1998/99)	65.7	44.1	55.3	68.6	80.3	92.8
to doctor	49.3	26.9	37.0	48.6	65.1	83.3
to nurse or trained midwife	16.5	17.2	18.3	20.0	15.2	9.5
Rural	59.8	43.5	54.2	67.3	78.5	90.1
Urban	86.4	64.6	74.1	76.2	83.4	94.1
Nepal (2001)	48.6	30.4	37.9	50.8	57.5	79.5
to doctor	16.6	6.2	8.5	12.7	18.5	48.2
to nurse or trained midwife	31.9	24.2	29.4	38.0	39.0	31.3
Rural	46.1	30.4	37.7	50.8	56.7	75.9
Urban	80.9	n.a.	(51.8)	(49.7)	77.4	85.8

Source: Gwatkin and others 2007a, 2007b, and 2007c.
Note: Numbers in brackets "indicate the absence of adequate observations to produce acceptably reliable values" (Gwatkin 2007c).

be fairly even across sexes, with a slight advantage for women in most countries. For Asia overall, WHO, UNAIDS, and UNICEF (2007) find that women account for 39 percent of people receiving antiretroviral treatment, which is higher than their share in the population of people living with HIV and AIDS (32 percent). The only South Asian country for which these data are available is India, with a share of women among people living with HIV and AIDS of 39 percent, while they account for 33 percent of people receiving treatment.

Finally, one factor that may be relevant regarding inequities in access to treatment in South Asia is the role of injecting drug users. Aceijas (2006) reports that they accounted for 1.4 percent of people receiving treatment in India at the end of 2004. Given that injecting drug use is considered the main factor in the spread of HIV in northeast India, and an important factor in other areas, this rate is certainly much lower than the share of injecting drug users among people living with HIV and AIDS. Thus, this factor points at the possibility that difficulties involved in providing treatment to high-risk populations contribute to low rates of access to treatment.

Summary and Conclusions

The picture that emerges regarding the economic development impacts of HIV and AIDS is complex; key findings include the following:

- The impacts of HIV and AIDS on GDP per capita are small. For India, the level effect on GDP per capita (–0.16 percent) corresponds to the equivalent of a one-off loss of about 1.5 weeks of GDP growth, and the slowdown in population growth implies a slowdown GDP growth of 0.02 percentage points through 2015, and a smaller decline later on. (Some factors, for example, regarding human capital accumulation, may exacerbate the negative impacts in the longer run, but we have no data suitable for quantifying these effects at present.)
- Using a simple model that evaluates the direct welfare costs of increasing mortality, we find that these welfare costs are substantial, accounting for 3 percent to 4 percent of GDP in India and Nepal, the countries with the highest prevalence rates in the region.
- HIV awareness is substantially lower for the lower wealth quintiles. Within quintiles, awareness is lower for women and for rural households.
- In a household study on India, 36.5 percent of people living with HIV and AIDS who were able to retain their employment nevertheless reported an income loss, which averaged about 9 percent. Among those who lost their employment (about 9 percent of the sample of people living with HIV and AIDS), the income loss was severe, at about 66 percent.
- The ability to cope with the financial effects of HIV and AIDS differs strongly across wealth quintiles. For the lowest wealth quintile, Pradhan and others (2006) report savings rates of –23 percent for households affected by HIV and AIDS, as opposed to 0 percent for the non-HIV group.
- Based on household data from India, we find that the situation of HIV-positive widows is worse than for other people living with HIV and AIDS, probably reflecting the status of widows in general. As many women living with HIV and AIDS are widows (reflecting an infection pattern whereby women frequently are infected by their husbands, who acquire the virus through various forms of risky behavior), this means that HIV and AIDS does have a disproportionate economic impact on women.

- In India and Nepal, the number of orphans will increase by about 0.4 percent. By age 17, about 0.9 percent of the young population will have experienced orphanhood owing to HIV and AIDS.
- We find access to antiretroviral treatment (about 20 percent in India, and less than 10 percent in the other countries) in the region to be low in an international context. In many countries in the region, one key factor that appears to limit progress in scaling up is the low capacity of national health systems, as well as less support from international initiatives (countries in other regions with low capacity and weak systems have higher ART coverage).
- Using largely circumstantial evidence (for example, access to other forms health services), we find indications for inequities in access to health services across socioeconomic groups. To the extent that these inequities also extend to access to antiretroviral treatment, they exacerbate the disproportionate impact on poorer population groups.

One point that needs emphasizing is the lack of data on the socioeconomic dimension of HIV and AIDS in South Asia, especially beyond India. Our discussion of the impacts of HIV and AIDS largely rests on surveys matching households affected by HIV and AIDS with a control group; while this may represent a best-available approach, it is problematic because it rests on first identifying households affected by HIV and AIDS, which means that the sample largely consists of people living with HIV and AIDS who receive some kind of HIV and AIDS-related medical attention, and who likely are not representative of the population affected by HIV and AIDS. At least for India, the recently completed *2005–2006 National Family Health Survey* may provide some improved insights regarding the socioeconomic dimension of HIV and AIDS. Along the same lines, our knowledge of the extent and determinants of access to antiretroviral treatment is very limited, beyond estimates of the overall number of people receiving it on a national level.

In terms of policy implications and a research agenda, the key findings from our analysis (data permitting) relate to the socioeconomic profile of the epidemic. In terms of the susceptibility to HIV, as well as the implications for living standards, we find that the vulnerability to and the impact of the epidemic differs strongly across population groups by wealth, education, and gender. This is an important finding toward understanding the impacts of the epidemic, as many of the implications of HIV and AIDS in the context of attaining the Millennium Development Goals arise from these discrepancies across population groups. At the same time, our findings highlight the complexities of the response to HIV, as evident, for example, from our findings regarding the linkages of access to treatment and the strength of health systems, or the apparent relationship between access to education and HIV awareness.

Notes

1. This comparison is based on age-standardized estimates of mortality from WHO (2006c). AIDS-related mortality for India was scaled in line with updated estimates of HIV prevalence and mortality for this country.
2. A different approach would involve obtaining such coefficients based on the larger set of countries for which estimates of the impact of HIV and AIDS are available. We have therefore run regressions, using estimates for the 62 countries covered by UN Population Division (2007), to obtain more precise approximations for the underlying demographic model that could be used to fill in the blanks. However, we adopt the simpler approach because HIV prevalence explained most of the variation in key indicators in these regressions (typically, around 95 percent), the role of interactions with other variables is limited, and because the data set of 62 countries, including countries with very different demographic profiles compared to the South Asian countries we focus on, may be less representative of the South Asian countries (excluding India) than India is.
3. While adjusting for the overestimates of the scale of the epidemic by scaling the estimated demographic impacts accordingly, we are not able to disentangle the effects that the corresponding underestimate of the coverage rate of treatment had on the estimated indicators of the demographic impact of HIV and AIDS.
4. More recent surveys of the available literature, for example, UNAIDS (2007) and Coffie and others (2007), suggest somewhat longer survival periods.
5. Haacker (2004b) provides an overview; Bloom and others (2004) discuss this and other approaches and draw some inferences regarding the impact of HIV and AIDS in Asia.
6. This assumes a direct effect productivity of 0.05 percent, in the interior of the range quoted. The multiplier effect (taking A to the power $(1/(1-\alpha)$; see equation (2)) increases the direct effect to about 0.08 percent.
7. Similar to our simple analysis, many studies of the economic impacts of HIV and AIDS in various African countries find large declines in GDP (relative to a baseline scenario), but much smaller declines in GDP per capita. In other words, the slowdown in GDP is dominated by a decline in population growth.
8. For example, Shantayanan and Nabi (2006) do not identify HIV and AIDS among the challenges to sustaining growth in South Asia. Some earlier

studies, such as Eberstadt (2002), predicted a more significant impact on longer-term growth, but on the basis of demographic scenarios that have not borne out.

9. A finer point is that the impact of HIV and AIDS may not be fully captured in national income accounts, for example, when commercial sex work takes place in the informal sector.
10. A note is in order regarding the role of surviving dependents, especially children, who are not included in the above presentation, but could well be captured in the individual's welfare function by adding a term describing the appropriately weighted welfare of an individual's offspring to eq. [(3)]. This would not yield fundamentally different results, especially when the individual expects that his or her children would be affected by an epidemic like HIV in a similar fashion.
11. As the compensating variation, in our context, is always larger than the equivalent variation, it is important to make clear which measure is used. If we do not state so explicitly, all our estimates of welfare costs of HIV and AIDS relate to the equivalent variation.
12. This estimate is motivated by empirical studies analyzing the link between wage differentials and differences in mortality risk across occupations. The fact that the "conversion factor" is higher than one reflects risk aversion and the declining marginal utility of consumption. Philipson and Soares (2005), drawing on similar sources, use a somewhat lower value (about 2.9, obtained as the inverse of the consumption elasticity of the utility function of 0.346 quoted in their study).
13. An alternative approach that is sometimes used values the economic losses to households based on earnings lost owing to premature death. Under certain assumptions (full employment, fully integrated labor market), the earnings lost are equal to the accumulated losses to GDP over time owing to a premature death (but substantially understate the individual costs of the risk of premature mortality according to the micro-based framework we apply). Using this approach, the Asian Development Bank and UNAIDS (2004a, 2004b) estimated that the cost of HIV and AIDS amounted to US$13.7 billion in 2004, corresponding to about US$17,000 per AIDS death.
14. The declines in the savings rate may be larger than reported in table 3.4, as it is not clear whether household borrowing is factored in.
15. For example, Botswana, Namibia, or South Africa.
16. The assumed cap on paternal mortality is consistent with the scant evidence suggesting high rates of coinfection among couples, which would not allow for large differences in HIV prevalence between parent couples. Alternatively, this adjustment is consistent with an assumption that men engaging in high-risk behavior may have a lower propensity to procreate.

17. A rate of double orphans among AIDS orphans of one-quarter is lower than in countries for which estimates exist (essentially, Sub-Saharan Africa, where double orphans account for about one-third of AIDS orphans). However, the differences in male vs. female HIV prevalence imply a lower share of double orphans.
18. These findings are similar to estimates by Case, Paxson, and Ableidinger (2002) for Sub-Saharan Africa.
19. On this issue, see Case and Paxson (2006), or Case, Paxson, and Ableidinger (2002); however, both studies are dealing with Sub-Saharan Africa.
20. See Gertler, Levine, and Martinez (2006) for a study using data from Indonesia.
21. For example, the studies quoted for Mongolia and Vietnam only have 24 and 11 observations, respectively, for two-parent orphans.
22. The range primarily reflects differences in GDP per capita across countries, although differences in health spending across countries also play a role (see table 3.10).
23. The upper panel of figure 3.4 also illustrates another aspect of the correlation between HIV and AIDS and GDP per capita regarding South Asia. The South Asian economies are among the few low-income economies that have been successful in containing HIV prevalence at levels below 1 percent.
24. See Haacker (2008) for more details.
25. Standard errors in parentheses. Three and two stars indicate coefficients significant at the 1 and 5 percent confidence levels, respectively.
26. As the costs of monitoring include personnel costs, they may differ across countries in line with different levels of income and, on a macroeconomic level, GDP per capita. However, GDP per capita for most countries shown is within or close to the range spanned by India and the Philippines (about US$500–US$1,000), so these estimates probably are not unreasonable for most low- and low-middle-income countries in the region.
27. Das and others (2006) provide a discussion of the quantitative impact of changes in prices of antiretroviral drugs and CD4 test kits.
28. Depending on the state of the epidemic, the share of people requiring treatment may differ across countries. For example, in the context of an escalating epidemic, following a rise in HIV prevalence, the share of people living with HIV and AIDS requiring treatment would be relatively low. Using a common benchmark for the share of PLWH requiring treatment neutralizes this short-term effect on our cost estimates.
29. These assumptions are inspired by UNAIDS 2007, and Coffie and others 2007.
30. This finding about the urban/rural differential is in line with findings reported in Pradhan and others (2006), who report that 17.7 percent of the people living with HIV and AIDS they surveyed were receiving antiretroviral treatment in urban areas, as compared to 10.3 percent in rural areas.

(As the sample includes people living with HIV and AIDS already identified and receiving some kind of medical attention, the share in this group receiving treatment is much higher than for the general population).

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CHAPTER 4

Economic Cost of HIV and AIDS in India

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Introduction

According to the latest available estimates, there are currently about 2.5 million people living with HIV or AIDS in India, corresponding to a HIV prevalence rate of 0.36 percent for the population ages 15–49 (IIPS 2007). While HIV prevalence thus remains relatively low, there are several factors that are unique to India's HIV epidemic, and need to be taken into account when assessing the impact of HIV and AIDS. (1) The scale of the epidemic and patterns of infection differ across states, and even between neighboring districts (see Wilson, this volume). Together with the fact that some of these states and districts are larger than many African countries affected by HIV and AIDS, this illustrates the complexities of the response to HIV and AIDS in India. (2) Of the two types of HIV virus—a slow-progressing one and a fast-progressing one that kills within six to nine years without any antiretroviral therapy—the latter type of virus is the predominant one in India. (3) India is a predominantly poor country with low levels of nutrition and high exposure to various types of bacteria and viruses, including tuberculosis—factors that exacerbate the morbidity and mortality of HIV and AIDS.

Against this background, our study of the economic costs of HIV and AIDS in India relates to two different strands of literature on the economic implications of HIV and AIDS.

- Studies estimating the aggregate economic impact of HIV and AIDS. The most important approaches under this heading are (1) studies focusing on the impacts on GDP or GDP per capita, and (2) studies estimating welfare costs, which are defined more broadly, including by making explicit allowance for the impacts of HIV and AIDS on mortality.
- Studies focusing on the household-level effects of HIV and AIDS. Findings from such studies frequently accentuate not only the high costs of HIV and AIDS to the affected households and individuals, but also differences in the vulnerability to and the impacts of HIV across population groups.

Our study draws from and builds on both of these strands of literature. In terms of the *theoretical framework*, it is related to prior studies using an explicit utility framework to capture the welfare costs of increased mortality (see the discussion by Haacker, this volume). One important shortcoming of these approaches is that they put strong emphasis on the welfare effects of increased mortality, while estimates of the impacts of HIV and AIDS based on household surveys typically suggest a much more complex impact on the well-being of household members.

Meanwhile, much of the evidence of the impacts of HIV and AIDS obtained from *household surveys* is indirect. One reason for this is that, owing to the generally low HIV prevalence in South Asia, household studies include few questions that offer direct insights regarding the impacts of HIV and AIDS. For example, much of our understanding of the implications of HIV and AIDS on orphanhood or widowhood derives from studies focusing on the status of orphans and widows in general, but are not specific to HIV and AIDS.

Our study provides added value relative to both of these strands of literature. First, we offer a theoretical framework that captures more of the richness of the impacts of HIV and AIDS evident from household surveys. A key aspect of the impacts of HIV and AIDS in this framework is the impact on "mental health" (as opposed to physical health), which we measure based on survey responses regarding the subjective well-being of respondents. Second, our survey is designed from the outset to capture the multiple impacts of HIV and AIDS. In addition to data on the economic impacts and consequences of HIV and AIDS (income, medical expenditure, wealth), we obtain measures of the impact of HIV and AIDS on both mental health and physical health.

The chapter is organized as follows. We start out by discussing in more detail the *context* of our chapter in terms of the available studies of the economic impacts of HIV and AIDS in terms of the impacts on growth, GDP, or income, and in terms of the broader welfare effects (typically focusing on increased mortality). Additionally, we also introduce some of the literature from which our notion of "mental health" draws. This section is followed by a summary of our findings from a *survey of households affected by HIV and AIDS*. This is followed by an *outline of the model* used to analyze the costs of HIV and AIDS to the households affected, and a section describing the process of *estimating the costs of HIV and AIDS* and presenting our findings. A *concluding section* closes the chapter.

Context

Most of the studies projecting the impact of HIV and AIDS on the growth rate of per capita GDP use some version of the neoclassical growth model and typically estimate declines of 0.5 percent to 1.5 percent, even for the worst affected countries with more than 20 percent HIV prevalence rates.[1] For countries like India, with an HIV prevalence rate of less than 0.5 percent, this translates into very small effects of HIV and AIDS on growth (see Haacker, this volume). Somewhat differently, Young (2005) emphasizes the decline of fertility associated with the HIV epidemic. Using South African data, he estimated that the positive effects of lower population growth on real wages would be strong enough to offset other adverse effects.

A growing body of relatively recent literature (see, for example, Ferreira and Pessoa 2003; Bell, Devarajan, and Gersbach 2004, 2006; Corrigan, Gloom, and Mendez 2004, 2005) emphasizes the transmission of human capital across generations and concludes that by disrupting the mechanism that drives the process of the transmission of knowledge and abilities from one generation to the next, the AIDS epidemic will result in a substantial slowdown of economic growth. Part of the analysis relies on the dynamic implication of the mechanism that AIDS lowers investment in human capital of children since ". . . the expected pay-off (*from this investment*) depends on the level of premature mortality among the children when they attain adulthood" (see Bell, Devarajan, and Gersbach 2006, page 59; our italics). This mechanism may be applicable for high-prevalence countries such as South Africa, but is not quite relevant for India, with a prevalence rate of just 0.36 percent and where there are many other compelling reasons for not sending children to school. Overall, it thus appears likely that the adverse impacts of HIV and AIDS on economic growth or GDP per capita in India will remain limited.

A different approach estimated the welfare impacts of HIV and AIDS as a decline in the utility that can be derived from a consumption stream over the lifetime of an individual. Using this type of model, Crafts and Haacker (2003, 2004) find that the primary impact of HIV and AIDS arises from its impacts on mortality (reducing the expected duration of the lifetime consumption stream). For India, Haacker (this volume), using this approach, estimates that the annual welfare costs of HIV and AIDS amount to around 3 percent of GDP, much higher than any estimates of the impact of HIV and AIDS on GDP.[2]

However, this approach is also not very well suited to capture the complexities and the implications of the impacts of HIV and AIDS at the household level. The most significant household survey regarding the impacts of HIV and AIDS in India to date is the one by Pradhan and others (2006, also discussed by Haacker, this volume). Their findings highlight the adverse impacts of HIV and AIDS in particular on households in poorer wealth quintiles and on widows affected by HIV and AIDS. More generally (not specific to India), studies using household data find a considerable impact of HIV and AIDS on income, consumption, and children's education. Booysen and Bachmann (2002) find that the decline in per capita income in HIV households in South Africa is 40 percent to 50 percent. while the fall in per capita food expenditure is 20 percent to 30 percent. In Indonesia, Gertler et al. (2003) find that death of a male in his prime is associated with a 27 percent reduction in mean per capita household consumption. Many studies have reported a negative impact of HIV and AIDS on children's schooling. Deininger et al. (2003) show that foster children were at a distinct disadvantage in both primary and secondary school attendance before introduction of universal primary education. Gertler et al. (2003) find that orphans are less likely to start school and more likely to drop out. Yamano and Jayne (2005) and Evans and Miguel (2005) find the negative impact of adult mortality on school attendance of children to be more severe in poor households.

Finally, we provide some background that motivates our interest in integrating mental health in the evaluation of the welfare costs of HIV and AIDS. Most directly, counselors and doctors working with HIV patients in India are unanimous in their opinion that the psychological and emotional costs on the HIV patients and their families are enormous. The medical science literature has long appreciated this aspect of terminal illnesses (see, for example, Emanuel et al. 2000; Grunfeld et al. 2004 for some recent work). In social sciences, this is related to an emerging body of literature on happiness and mental well-being (see, among others, Easterlin 1974, 2003; Blanchflower and Oswald 2004, 2007; Clark and Oswald 1997; Frey and Stulzer 2002; Gilbert 2006; Graham 2007; Helliwell 2006; Kahneman et al. 2006; Layard 2005; Lucas et al. 2004; Smith et al. 2005; Ubel et al. 2005). The mental well-being research is proven to be well suited in situations with limited information on welfare effects of unemployment, divorce, smoking, and so on. This approach can be used to evaluate effects of HIV and AIDS on significant fear of early death and stigma. While researchers have worked in painstaking details to investigate the determinants of happiness and mental well-being (see, for example, Andres 2004; Blanchflower and Oswald 2004, 2007; Case and Deaton 2006; Helliwell 2006), very little research has been done to quantify the value of mental health.[3] Given the importance of the psychological and emotional costs, the HIV experience in India gives us this unique opportunity to integrate mental health in welfare evaluation and to quantify its significance in welfare loss of the family.

A Survey of Households Affected by HIV and AIDS

In light of the low level of HIV prevalence in the population, our sampling process involves identifying households affected by HIV and AIDS through networks of physicians. The control group of "non-HIV households" is based on interviews of households from similar locations (villages, residential clusters). This process and other issues regarding the sampling process are discussed among our *considerations regarding data collection*. The presentation of our findings then proceeds in two steps. First, we present data on *socioeconomic characteristics of individuals and families affected by HIV and AIDS*. Second, we discuss our findings regarding variables included in the survey to serve as *indicators of the impact of HIV and AIDS*, such as measures of physical health, mental health, or the impact of HIV and AIDS on the household's labor supply and income. Our discussion is rounded out by a presentation of several case studies of households affected by HIV and AIDS (box 4.1).

Box 4.1

Case Studies of Financial Impact of HIV and AIDS

Case 1. Both adults HIV-positive (time since detection: 1 month). The surveyed patient is a 28-year-old woman from Jamalpur, U.P., who has been diagnosed with HIV a month ago. She had studied up to eighth grade and her husband up to ninth grade. She is a housewife and is getting herself treated in a free government clinic in Delhi. She spends about three days on the trip to Delhi to get her medicines. Her husband, who used to own a truck and drive it, was also diagnosed with HIV a couple of months ago and was probably the source of her infection. He used to earn about Rs. 15,000 a month, but recently, due to recurring fever, has been unable to work any more. The patient recently had a stomach surgery at the cost of Rs. 30,000 in a private hospital. The family has sold their truck for only Rs. 50,000. Jewelery valued at Rs. 7,000 has been sold out of the stock valued at Rs. 9000. Their entire personal savings of Rs. 10,000 has been spent, and the patient's husband has borrowed Rs. 10,000 from one of his siblings. The couple lives in a joint family with his parents in their ancestral home. Currently her father-in-law, with an income of Rs. 4,000–5,000 per month, provides for their living expenses. The family has cut down on their food, clothing, and entertainment expenses.

Case 2. Both adults HIV-positive (time since detection: 2 months): The patient is a 37-year-old man in Orissa who owns a tea stall, and three months ago used to earn Rs. 4,000 per month. He has five years of schooling, while his wife has four years of schooling. He has been suffering from TB for six months and was diagnosed with AIDS two months ago. His wife has also been detected with HIV, but has no symptoms. Her ex-husband died of TB. The patient thinks that he got infected during tattooing, but he may have contracted the infection from his wife, who in turn had the virus transmitted from her ex-husband. The family lives in an ancestral house. They have spent Rs. 12,000 on testing and medicines in the last three months. Currently, the family income is zero, whereas the medical bill is Rs. 7,000 per month. The patient firmly believes that with good medicines he will recover fast and go back to work. The monthly household expenses of Rs. 9,300 are being paid by his brothers. It is not clear how long it is feasible for this transfer to continue.

Case 3. HIV-positive widow (time since detection: 1 year): The patient is a 40-year-old illiterate widow living in Delhi. She lives with her two sons' families. She owns the house she lives in, but her sons pay for her living expenses. The family income is only Rs. 4,000 per month, and, not surprisingly, the family did not have any savings when she fell ill. She says that she got infected due to unprotected sex with her neighbors after her husband died. During detection of her infection a year ago, the family spent Rs. 36,000 on testing and medicines, and currently her monthly medical expenditure is Rs. 1,500 per month. But since her detection she has sold one room of her two-room house for Rs. 75,000 and jewelry of Rs. 5,000. In addition, she has taken a loan of Rs. 50,000 from a money-lender. The loss of assets and increase in indebtedness do not match her medical needs. Perhaps there is some other reason that has not been mentioned. She is still in a state of depression. As compared to the family income, the financial loss in just one year is quite staggering.

Case 4. Man HIV-positive, woman HIV-negative (time since detection: 1.8 years): The patient is a 24-year-old male from U.P. who lived away from his family while working in Orissa for two years. He is a college graduate and his wife has studied up to two years in college. He used to earn Rs. 6,000 a month at a government job. He suspects that he got infected due to unprotected sex with commercial sex workers (CSWs). His infection was detected only when he returned home two years ago with TB and recurring fever and was unable to work any more. He believes he will not be able to work ever again. He now stays in his ancestral home with his wife, one child, parents, and two siblings. His wife is not infected and is a housewife. As he is unable to work, his parents, with an income of Rs. 8,100 per month, support him and his family. Since the time of detection they have spent Rs. 31,000 on testing and medicines. In addition, their monthly expenditure on medicine has gone up by Rs. 1,000. But the nuclear family is managing well due to the support of the extended family. The patient has current personal savings of Rs. 10,000 and has not had to sell any assets or take loans to cover his expenses.

Case 5. Both adults HIV-positive (time since detection: 2.8 years): The patient is a 27-year-old male from Haryana, who has been living with his wife, children, parents, and siblings. He has studied up to fifth grade and before detection he earned Rs. 5,000 per month working as a truck driver, staying away from his wife an average of 12 days in two weeks. He suspects that he got infected due to unprotected sex with CSWs. Currently he is unable to take the strain of his earlier job in which he worked for 12 hours every day, and instead works on his family farm for two hours daily. After his detection, his wife was tested and was also diagnosed with HIV the same month, most likely infected by her husband. But she is totally asymptomatic and continues to work on the family farm as before. Their

(continued)

Box 4.1 *(Continued)*

family income is Rs. 3,300 per month. Their loss of income due to HIV is Rs. 5,000 per month. He has spent a total of Rs. 3,850 on his medicines and testing. As a result of low income they have to curtail their monthly expenditure on food and clothing by Rs. 140, but have increased medical expenditure from nothing to Rs. 600. His father now pays Rs. 1,000 per month. In addition, the family has borrowed Rs. 50,000 from a moneylender at a monthly interest rate of 2 percent, which they believe they would be able to pay off in the coming two years. But given that they are barely surviving with their current income, it is not clear how they will manage to do so.

Case 6. Man HIV-positive, woman HIV-negative (time since detection: 5 years): The patient is a 41-year-old male from Orissa who lived away from his family in Surat working as a factory worker. He was diagnosed with HIV five years ago. He worked for 12 hours a day, 7 days a week, and made Rs. 3,000 per month. Both husband and wife have studied up to third grade. Since his detection he lives with his family in Vishakhapatnam (closer to Orissa than Surat), where he and his wife sell snacks. His wife is not HIV positive. Earlier his wife did not work. Their family income is now only Rs. 1,600 per month. In the five years since his detection, the family has sold Rs. 35,000 worth of jewelery, and spent their entire personal savings of Rs. 20,000. In addition, they have also borrowed Rs. 40,000 from a moneylender at a monthly interest rate of 2 percent for treatment.

Source: Authors' study.

Considerations Regarding Data Collection

To better understand the social and economic impact of HIV and AIDS for the individuals affected and their households, and—ultimately—to arrive at estimates of the economic cost of HIV and AIDS in India, we need a data set describing the socioeconomic characteristics of households affected by HIV and AIDS, as well as corresponding data for a control group not affected by HIV and AIDS. In some countries with high prevalence rates of HIV and AIDS (for example, South Africa, with an estimated HIV prevalence of 19 percent of the population ages 15–49), such data are usually obtained by adding questions regarding the HIV status or the impact of HIV and AIDS to household surveys. The same approach does not work well in India, especially for a survey specifically designed to capture the impacts of HIV and AIDS, as obtaining responses from an adequate number of people living with HIV and AIDS (say, 500) would require sampling a very large number of people not affected by HIV and AIDS (about 100,000, assuming an HIV prevalence around 0.5 percent) as opposed to a sample of about 2,600 in South Africa to locate 500 with HIV and AIDS. .

Second, in light of the paucity of data on the socioeconomic effects of HIV and AIDS in India, we designed a relatively elaborate questionnaire, which took about 1.5 to two hours to fill out. Also, soliciting responses from families affected by HIV and AIDS is a formidable task to start with due to the confidential nature of HIV infection. To ensure the necessary trust of patients, we expected that only doctors who knew us personally (including some of our field surveyors who worked with HIV patients earlier) would agree to the surveying of their patients, and the latter would trust our word of confidentiality.

We thus started with our professional network of physicians in New Delhi, who referred us to other doctors/NGOs in various parts of the country. In this manner, we collected data from both high- and low-prevalence states where transmission was predominantly heterosexual, as 86 percent of all transmission in India is through this route (table 4.1). At the same time, the sample states represent the four different regions of India: north (Delhi and Uttar Pradesh), south (Tamil Nadu and Andhra Pradesh), east (Orissa), and west (Maharashtra). Overall, our sample comprises 371 families where there is at least one member who is infected by HIV (*HIV families*).[4] We have also collected data from 479 families where there is no reported incidence of HIV (*non-HIV families*). The selection of non-HIV families was based on geographic proximity (same district and, where possible, same village or same residential cluster in a town)[5] and economic similarity (based on similar kind of residence) to the surveyed HIV

Table 4.1 Regional Distribution of Sample (Units)

State	*Families affected by HIV*	*Families not affected by HIV*
Low-prevalence states		
(Delhi, Uttar Pradesh, Orissa)	179	268
High-prevalence states		
(Tamil Nadu, Andhra Pradesh, Maharashtra)	192	211
Total	371	479

Source: Authors' survey.

families.[6] The distribution of HIV and non-HIV families across the different regions is given in table 4.1. In our analysis, we look at the effect of HIV on the infected adult, his or her spouse (if living) and his or her children (if present). We define this unit as "*family*." This is different from a *household*, as there may be members other than the above individuals in cohabitation, but we ignore the effects on them.

The doctors/NGOs explained the motives of our study to their patients, but the choice to be surveyed was ultimately left to individual patients. All patients contacted by an NGO in a state (Andhra Pradesh and Orissa) agreed to be surveyed and were surveyed by local personnel of the NGO (due to language constraints) in their households, but after being trained by our surveyor from Delhi. Consent forms were signed by all. Patients of doctors were mainly surveyed at the hospital or clinic of the doctors. A few declined the survey due to shortage of time. Seven of the patients mentioned only their district of residence rather than their village.

Even though this sample is not random, it is not a result of endogenous sampling, either. The criterion on which our sampling was done is largely uncorrelated to the nature of HIV infection, and standard econometric methodology is valid. We may be missing some rich urban patients who go to private doctors and are reluctant to participate in surveys, or infected individuals who do not receive treatment by a doctor. But this criticism is equally valid with regard to the profile of patients collected by the official National AIDS Control Organisation (NACO), or essentially any other HIV and AIDS-related survey, and we are therefore confident that our approach represents best practice. To account for oversampling of HIV patients in the overall population, we have used appropriate weights using NACO figures in our prediction of the effects of HIV and AIDS for the entire country.

Socioeconomic Characteristics of Individuals and Families Affected by HIV and AIDS

The total number of HIV-affected individuals in our sample is 497, of which 58 percent (288) are male and 42 percent (209) are female. HIV prevalence is highest among the cohorts ages 25–35 (table 4.2). Women tend to become infected at an earlier age. More than half of the women diagnosed with HIV and AIDS are age 30 or younger, but only 38 percent of males belong to this age group. The mean age of people living with HIV and AIDS is 33.

The occupation profiles of people living with HIV and AIDS (table 4.2) differ significantly by gender. Most of the males worked as factory

Table 4.2 Age Distribution and Occupation of HIV-infected Individuals
(Percent)

Age range	*Male*	*Female*	*Occupation (before being diagnosed with HIV)*	*Male*	*Female*
			Agricultural laborer	4	10
0–5	2	2	Unskilled worker	6	6
6–10	0.7	1	Truck driver	6	0
11–14	0.4	0.4	Auto/taxi/car/bus driver	10	0
15–18	0.8	0.0	Industry and factory worker	26	3
19–24	7	16	Hotel staff	3	0
25–30	27	32	Business owner	3	0
31–35	33	20	Petty shop owner	4	3
36–40	20	11	Housewife	0	60
41–45	11	2	Student	4	2
46–49	3	1	Other services	5	2
50+	5	2	Unemployed	5	3
Total	100	100	Other occupations	24	10
			Total	100	100

Source: Authors' survey. Data may not add up to 100 due to rounding.

workers, or in certain types of services.[7] We highlight this here because of the increasing concern of HIV being spread among migrant laborers. Most of the factory workers and auto/bus drivers belong to this group. Among HIV-affected females in our sample, about 60 percent were housewives, while the next biggest group is agricultural laborers. The high share of female agricultural laborers may reflect that these are frequently spouses of migrant workers, suggesting one way in which the HIV virus enters the rural economy, that is, through migrant workers infecting their spouses when they visit home.

The average years of schooling among HIV-infected males is 10.3 years, while the average years of schooling among males in the control group is 8.4 years. The corresponding figures for females are 5.46 years and 5.2 years, respectively. While the PLWHA (people living with HIV and AIDS) in our sample are not very educated, it is interesting to note that the level of education among males is higher than that in the control group.

Additionally, our data capture the amount of time passed since a person was diagnosed with HIV, varying from less than a month to seven years (table 4.3). Consistent with our findings regarding the composition of "ever-married" households (mostly female or female-led, suggesting that in many cases of coinfection, males die first), we see that

Table 4.3 Time since HIV Detection

Age range	*Total*	*Males*	*Females*
Less than or equal to 6 months	30	28	34
7 months – 1 year	17	17	17
1–2 years	17	17	17
2–4 years	26	28	24
4–7 years	10	12	8
Total	100	100	100

Source: Authors' survey. Data may not add up to 100 due to rounding.

Table 4.4 Distribution of Households by Family Type
(Percent)

Family type	*HIV*	*Non-HIV*
Currently married	61	71
Never married	14	22
Ever married	25	7
Total	100	100

Source: Authors' survey. Data may not add up to 100 due to rounding.

among people living with HIV and AIDS, males are—on average—infected earlier than women.

Table 4.4 shows the various kinds of family structures in our data. Our sample includes "currently married" families where both adults are alive, never-married families (unmarried males or females) and "ever-married" families (widows, widowers, separated, and divorced). The higher proportion of ever-married families among HIV families is in most cases a consequence of death of an adult due to HIV and AIDS.[8] Our data point at the important role of coinfection between couples—in 54 percent of the "currently married" families affected by HIV and AIDS, both adults are infected with HIV and AIDS, while in 42 percent of them, only the male adult is infected, and in only 6 percent of cases only the female adult is infected. A one-member family is "male" or "female," depending on the gender of the only adult member. Of the never-married HIV "families" 84 percent are male, while 76 percent of the ever-married families are female. These cross-sectional data also provide some pointers regarding the dynamics of infection and coinfection between couples, as they are consistent with a pattern in which HIV in many cases is acquired first by a male, who then passes the virus on to his wife.

There are 1,418 children in our sample, of whom 1,189 are less than 18 years of age. The average number of such children per HIV family (among families who have children) is 2.16, while the average number of such children per non-HIV family is 2.22. We assume that parents make decisions for children who are 18 years old or younger, and that children older than 18 are able to make decisions for themselves. For obvious reasons, schooling decisions are considered only for children of age 6 and older. The total number of such children is 892. Among HIV families, the average number of such children is 1.9, while the corresponding number for non-HIV families is 2.1.

Indicators of the Impact of HIV and AIDS

While the preceding section focused on indicators of the socioeconomic structure of families and individuals affected by HIV and AIDS, the present section discusses findings regarding variables that capture the impacts of HIV and AIDS on health, well-being, and the economic status of those affected.

Physical health status (H). The survey asked a number of questions on the occurrence of common symptoms of infection (fever, diarrhea, cough and cold, loss of appetite, general body ache, headache), and regarding some diseases and symptoms that are seen more often in HIV patients than non-HIV, such as tuberculosis, oral ulcers, and genital ulcers. The reference period for the above symptoms was the last three months.[9]

Given the symptoms, we enlisted an expert on HIV and AIDS assessment and treatment at a government antiretroviral treatment (ART) clinic, who assigned a numerical index based on the symptoms for all of the HIV and non-HIV respondents. This study uses that index as a measure of morbidity. The index ranges from 1 to 11, with 11 being the healthiest and 1 being the worst health. Where possible, we also tried to measure height and weight of individuals to be able to calculate a body mass index (BMI), which is commonly used as a measure of physical health. We also asked HIV patients to recall their normal weight before HIV detection, but in many cases where we felt the patient was not sure we did not record his or her weight. Table 4.5 summarizes various health indices by gender and HIV status.

Our data suggest a moderate decline in BMI following detection, and a lower BMI for people living with HIV and AIDS relative to the non-HIV group. However, none of these differences are statistically significant at a 5 percent confidence level. The health index based on morbidity is significantly lower for HIV individuals as compared to that of non-HIV individuals (t value of 16.5; significant at 1 percent under the alternative

Table 4.5 Health Indices

Age range	*Health index (Current)*	*Body mass index: BHD**	*Body mass index: Current*
HIV			
Male	7.8 (1.8)	20.26 (2.95)	19.04 (3.03)
Female	8.6 (1.9)	21.67 (5.72)	19.76 (3.72)
Average family	8.5 (1.5)		
Non-HIV			
Male	10.3 (1.1)	n.a.	20.78 (3.61)
Female	10.5 (0.9)	n.a.	20.90 (4.29)
Average family	10.3 (0.8)	n.a.	

Source: Authors' survey.
Note: Standard errors in parentheses.
* Based on a smaller sample.

hypothesis that non-HIV morbidity is higher). In our sample, the morbidity of HIV males is significantly higher than that of HIV females, which may reflect that usually husbands are infected earlier.

Since our analysis is at the family level, we construct the average health of a family by taking the mean over the health of existing adults in the family. This controls for the different number of adults in families. Thus, as expected, HIV families have lower physical health as compared to non-HIV families.

Mental health (M). Indicators of mental health (IMH) are based on self-reported occurrence of some feelings in a reference period by the respondent and spouse (for married respondents). Questions on feelings were asked using the questions in Case and Deaton (2006). The following statements were made and the respondents were asked if in the last 15 days the feeling captured by each statement occurred "hardly ever, sometimes, most of the time, or never."

- I felt that I could not stop feeling miserable, even with the help of my family and friends.
- I felt depressed.
- I felt sad.
- I cried a lot.
- I did not feel like eating; my appetite was poor.
- I felt everything I did was an effort.
- My sleep was restless.

The ranking of mental health was obtained by assigning a number to each answer: “never” was given 4 points, “hardly ever” 3 points, “sometimes” 2 points, and “most of the time” 1 point. Using these values, we constructed two indices: The minimum of the points across all questions answered by the respondent and, where present, by his or her spouse (denoted IMH_1 in table 4.6). This is the Rawlsian “maximin” criterion and is consistent with basic axioms regarding aggregation (Sen 1986). It does not rely on cardinality (as an average would have), and gives equal importance to all questions. It does, however, assume comparability of this ordinal measure across different subjects. To check if this makes a big difference, we also consider another index (denoted IMH_2 in table 4.6) which is similar in its Rawlsian flavor but uses responses to only one question: “I felt depressed.”

Table 4.6 summarizes the distribution, with higher values of the index indicating a higher level of mental health. It is clear that the distribution of IMH_1 as well as IMH_2 for non-HIV families always dominates the distribution for HIV families. Thus, non-HIV families are mentally better off whichever index one considers.

Presence of stigma. What makes HIV different from many other diseases is the fear of stigma. In our sample, there are a large number of individuals who have not disclosed their infection to either their household members or their neighbors or their friends or at their workplace. Table 4.7 summarizes the proportion of HIV-positive individuals who have not disclosed their HIV status. This information is available only for the main respondent with HIV of the family. In cases where spouses are HIV positive we do not have the necessary stigma information for each separately.

It is apparent that patients generally avoid telling people outside their immediate household about their HIV infection. However, it could be

Table 4.6 Mental Health: Relative Frequency
(Percent)

	HIV families		*Non-HIV families*	
	IMH_1	*IMH_2*	*IMH_1*	*IMH_2*
“Most of the time” (1)	82.43	57.77	37.74	5.76
“Sometimes” (2)	14.05	28.34	17.82	15.57
“Hardly ever” (3)	3.24	7.36	24.95	23.67
“Never” (4)	0.27	6.54	19.50	55.01

Source: Authors’ survey.

Table 4.7 HIV Patients Who Do Not Disclose Their Infection
(Percent)

Not disclosed to household members	25
Not disclosed to neighbors	74
Not disclosed to friends	72
Not disclosed at the workplace	85

Source: Authors' survey.

argued that this is merely a personal choice and not because of fear of discrimination. In our sample, among those who chose not to tell some of the above list of people, 64 percent reported that they did not do so because of one of the following reasons:

- They would think I was a person with bad moral values.
- They would force me to leave the community.
- My family would get a bad name.
- They would reject my whole family.

Thus the fear of stigma is not unfounded.

Labor supply. Our data regarding the employment status of people living with HIV and AIDS illustrate the impact of HIV and AIDS, but also the differences in the socioeconomic status of men and women. Table 4.8 shows that, for an employed HIV-positive male, the probability of becoming unemployed upon the HIV-positive status being detected and the workplace finding out is 20 percent. While some of that is offset by males who have gained employment since being diagnosed with HIV, the data point to a negative impact of HIV and AIDS on employment. Similarly, the sample unemployment rate among males living with HIV and AIDS (13 percent) is much higher than the rate of 5 percent for this group before being diagnosed with HIV (table 4.8). The picture for women is different: 21 of the 132 women living in families with HIV and AIDS who were unemployed or housewives before detection subsequently gained employment. One key factor behind this appears to be the loss of an income earner in the family, as 13 of these 21 women were widows.

Table 4.9 shows a similar picture. As expected, the health status of non-HIV males supplying labor outside the household is higher than for males living with HIV and AIDS, as well as for the non-HIV males who do not supply labor outside of the household. While the causality behind this correlation may run either way, we note that the gap between those

Table 4.8 Transition in Employment Status Following HIV Diagnosis
(Percent)

	Probability of Changing Status to:		
Status before HIV diagnosis;	*Employed*	*Unemployed*	*Housewife*
Employed			
Males	80	20	0
Females	90	8	2
Unemployed			
Males	7	93	0
Females	29	71	0
Housewife			
Nonwidow	11	0	89
Widow	35	0	65
Proportion of people living with HIV and AIDS by different status	74	15	11

Source: Authors' survey.

Table 4.9 State of Health by HIV Status and Gender (index)

	Non-HIV	*HIV*
Male labor supply is positive	10.34 (0.97)	8.09 (1.72)
Male labor supply is zero	10.08 (1.66)	7.02 (2.03)
Female labor supply is positive	10.45 (0.99)	8.53 (1.75)
Female labor supply is zero	10.57 (0.82)	8.72 (2.00)

Source: Authors' survey.
Note: Standard errors in parentheses. For details on the definition of the health index, see the discussion of the physical health status and table 4.5 above.

supplying labor and those who don't is much higher for people living with HIV and AIDS, suggesting that the impaired health status is causing the withdrawal from the labor market. For women, the health status of the group not supplying labor outside the household is somewhat higher than for those supplying labor outside the household, especially for women living with HIV and not supplying labor. This may reflect that the group not supplying labor is dominated by women from wealthier households, who withdraw from the labor market voluntarily and are in a better position to cope with the impact of the epidemic.

The effect of HIV can also be observed in terms of the quality of labor that is supplied. Table 4.10 highlights the self-reported effects on concentration during work and on problem-solving abilities. While in the short run these may not affect the wage earnings of the employed, they definitely affect their productivity and hence will affect the economy. Since

Table 4.10 Indicators for Impact of HIV and AIDS on Labor Productivity
(Percent)

Employed HIV patients who said "concentration/attention in daily work" had declined after HIV detection	54
HIV patients who said "speed in problem solving and decision making" had declined after HIV detection	56

Source: Authors' survey.

we do not explicitly model the production sector, we are not able to capture this effect here.

Morbidity may also affect the quantity of labor supplied, but there are also other factors that could play a role. For example, individuals could choose to supply labor based on wages; however, a simple correlation between wages and labor supply may be misleading if education levels sort individuals into various occupations, and a well-paying job comes with more certain employment and therefore more days of work.

For working males, we therefore check if the number of days of work in a week depends on the wage per day after controlling for their occupation, education, health status, the number of members in the family, and a dummy indicating whether the male is HIV-positive. We find that only the occupation dummies are significant (see appendix B, table B.1, for estimation results). This suggests that, conditional on being able to work, individuals cannot choose the number of days of work. This is consistent with the common notion of India being a labor-surplus economy. Hence, for the rest of the analysis, we take the labor days of males as exogenous with respect to wages.[10]

Effects on children. Does HIV in families affect school attendance? To answer this question, we measure the proportion of children in the age group 6–18 in a family (multiplied by the schooling expenditure on them to adjust for the quality of schooling) attending school. It seems that while both parents are alive, there is no big impact of HIV on school attendance. However, it is clear from the data on one-parent families that there are significant effects on school attendance when one parent is dead. From table 4.11 below, we can see that financial resources cannot be one of the reasons. This reflects the long-run adverse impact of HIV on human capital development.

Income, expenditure, and external funding. In order to obtain an impression of the forms the financial impacts of HIV and AIDS on families may

Table 4.11 HIV and AIDS and Children's Enrollment

	School attendance, ages 6–18 (Percent)	*Quality-adjusted attendance*
Families affected by HIV and AIDS		
Widow	73	71
Widower	75	106
Currently Married	93	152

Source: Authors' survey.

take, box 4.1 discusses a few cases in some detail. The first two cases examine the impacts around the time of an HIV diagnosis; the other four are spread out over the sample time span since HIV diagnosis. Most of the families covered in box 4.1 experienced a loss in income following the HIV diagnosis, an increase in medical expenditures, and a curtailing in nonmedical expenditures. In four of the six cases, the families received support from relatives. In many cases, the increased financial needs (owing to lower income and higher expenditures) were financed by liquidating family assets or borrowing from family or moneylenders.

Table 4.12 summarizes the income and expenditure profiles of families affected by HIV and AIDS, as well as those of the control group. In many cases, it is not possible to "translate" family support, the sale of assets, or borrowing into monthly financial flows. Our summary table therefore captures such flows only indirectly under the heading "dissaving/financial support," in terms of the excess of household expenditure over incomes.[11]

Per capita incomes of the HIV and non-HIV families are not significantly different from each other. Families headed by widows have the lowest income. In comparing married families with HIV and families headed by widows, it is interesting to note that while income falls for both families, per capita consumption does not. The main reason for this is likely the rather large amounts of net external funding.

Outline of the Model

The measurement of the economic cost of HIV and AIDS for India is based on a model given in detail in Das, Mukhopadhyay, and Ray (2007). This section sketches out the main arguments of that paper. The unit of analysis is the nuclear family, consisting of a man, woman, and their children. All economic decisions of the family, including the decisions for the children, are taken by the adult members. The family maximizes its utility

Table 4.12 Per Capita Inflow and Outflow of Funds (rupees per month)

	HIV	*Non-HIV*	
Family type	*Sample average (standard errors in parentheses)*		t *values**
Currently Married			
Income	930 (1,116)	1,109 (1,121)	**1.87**
Consumption expenditure	760 (721)	690 (764)	1.10
Medical expenditure	190 (276)	69 (186)	**5.80**
Schooling expenditure	40 (75)	37 (56)	0.51
Dissaving/Financial support	60 (913)	–312 (1,039)	**4.5**
Never Married			
Income	2,054 (3,156)	2,171 (2,510)	0.23
Consumption expenditure	2,664 (1,873)	2,123 (1,556)	**1.77**
Medical expenditure	1,675 (7,069)	237 (578)	1.44
Dissaving/Financial support	2,285 (7,639)	188 (2,594)	**1.89**
Ever Married (Widows)			
Income	541 (1,314)	178 (224)	**2.28**
Consumption expenditure	753 (831)	419 (285)	**2.70**
Medical expenditure	159 (272)	29 (41)	**3.75**
Schooling expenditure	25 (55)	18 (34)	0.65
Dissaving/Financial support	396 (1,134)	288 (439)	0.61
Ever Married (Widowers)			
Income	1,375 (2,264)	1,969 (2,033)	0.68
Consumption expenditure	706 (663)	901 (798)	0.59
Medical expenditure	349 (550)	254 (472)	0.43
Schooling expenditure	56 (78)	6 (11)	**2.51**
Dissaving/Financial support	–264 (1,207)	–808 (1,351)	0.96

Source: Authors' survey.
Note: Standard errors in parentheses.
*The *t*-value relates to the one-sided test with a null hypothesis H_0: $|Mean_1 - Mean_2| = 0$ and an alternate hypothesis H_A: $|Mean_1 - Mean_2| > 0$. Bold type indicates that H_0 is rejected at the 5% level.

by allocating consumption expenditure (c), spending on children's education, and medical expenditure, with a utility function of the form

$$u = \alpha \log c + \beta \log(1 + M) + \gamma \log(1 + SC \cdot P_s) \tag{1}$$

for families with school-age children, and

$$u = \alpha \log c + \beta \log(1 + M). \tag{2}$$

for families without school-age children. Expenditure on children's schooling is defined as the product of per capita schooling expenditure SC and the proportion of school-going children P_S.[12] We observe that a significant proportion of families in our sample (48 percent) do not have any children. We assume that these families do not put any weight on children's education, and hence maximize their utility only with respect to consumption and medical expenditure. Medical expenditure (*md*) enters the households' utility function indirectly as it affects the level of mental health (*M*), which is determined by

$$M = \delta_0 + \delta_1 \cdot md + \delta_2 \cdot H + \delta_3 HIV + 1 \cdot X. \quad (3)$$

Specifically, the link between medical expenditure and mental health may reflect the positive effect on expected future health for a given level of current health. Other key factors affecting mental health are the state of physical health *H* and whether a household is affected by HIV and AIDS (captured by an *HIV* dummy), as well as other household characteristics captured by the vector X (such as wealth, employment status, age, and gender) used in the recent literature on mental health and subjective well-being.[13]

Estimating the Costs of HIV and AIDS

In all our estimated equations we have pooled the relevant HIV and non-HIV samples. Since we have oversampled the former, we put low weights on those observations and higher weights on the non-HIV observations, so as to be representative of the Indian population (for details see Das et al.). The weights are computed using the overall prevalence data of the IIPS (2007) and the gender composition that is available from the National AIDS Control Organisation's last annual report.

We first estimate the mental health technology for all types of families for both indices of mental health—minimum mental health based on responses to all questions (IMH_1), and minimum mental health based on the question "I felt depressed" (IMH_2). Note that our mental health data are in discrete form, whereas the utility function uses a continuous measure. We easily obtain a continuous measure from the underlying latent variable obtained by estimating the mental health equation by ordered probit, which is appropriate for our observed ordered discrete measure of mental health. This is what we use in our utility function and empirical analysis below.

For both IMH_1 and IMH_2, better current health leads to better mental health. As hypothesized, controlling for health or HIV status, the higher the medical expenditure, the higher is mental health. This is an important result for our model. We also find that HIV infection affects mental health negatively, irrespective of which measure one chooses. For the rest of the analysis, we report the results based on the mental health measure IMH_1 as it is a comprehensive measure based on all questions asked relating to mental health.

Given the continuous mental health measure, we then estimate the parameters of the optimum conditions of utility maximization separately for families with and without school-age children. In each case we pool HIV and non-HIV families. These estimates pin down our indirect utility functions for the families. Then the impact of the HIV epidemic at the family level is calculated by comparing the indirect utility functions of the families affected by HIV and AIDS with those of families not affected. To distinguish among different types of families, we represent the status of a family by the vector *(i,j)*, with *i* representing the male adult, and *j* the female adult. The markers *i* or *j* can take the values +, –, 0, or *na* to indicate whether the respective family member is HIV-positive (+), HIV-negative (–), deceased (0), or not available for unmarried, one-adult families. The position of *na* is determined by the missing gender in the family adult vector.

Let $V^{(i,j)}(S)$ denote the indirect utility function when the family HIV status is (i,j), as defined above.[14] The loss to the country then is:

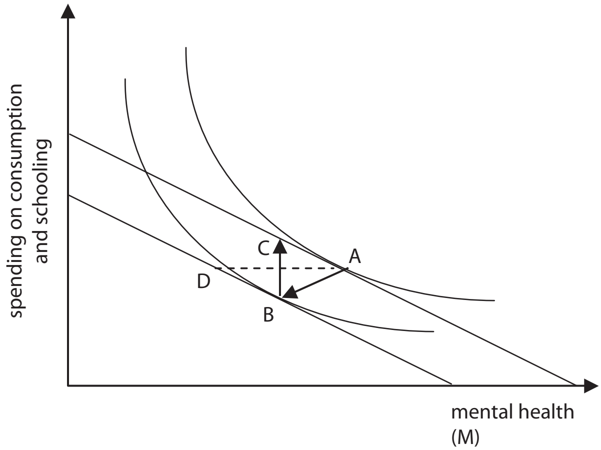
$$\int_{(i,j)} \left(V^{(-,-)}(S) - V^{(i,j)}(S)\right) \cdot d\mu(i,j),$$

where $\mu(i, j)$ stands for the measure of families with HIV status (i, j). To calculate the amount that would be required to compensate a family for the losses associated with HIV and AIDS, we introduce the parameter τ to denote the hypothetical transfer that is needed to equate the indirect utility of a given type of HIV family with the reference non-HIV family. In other words, the monetary equivalent of the loss to the family (i,j) is given by the transfer ($\tau^{(i,j)}$) measuring the compensating variation to the family (i, j) and is defined by:

$$V^{(i,j)}(S|\tau) = V^{(-,-)}(S|0)^{-15}.$$

Our findings are summarized in figure 4.1 and table 4.13. First, in terms of the direct impacts of HIV on mental health, we find that most of the reduced mental health can be attributed to impaired physical health (table 4.5) and to the HIV dummy, which may capture the implications for future health as well as some of the economic repercussions discussed

Figure 4.1 Estimating the Cost of HIV/AIDS



Source: Authors' calculation.

Table 4.13 Losses by Family Types

	Utility loss (per family per month): IMH_1 (Rs)	*Utility loss (per family per month): IMH_2 (Rs)*	*Loss from transfers (per family per month) (Rs)*
Currently Married			
Only male HIV	85,727	89,631	1,363
Only female HIV	68,502	83,658	574
Both HIV	91,663	101,266	1,327
Ever Married			
Widow HIV	94,394	106,063	2,214
Widower HIV	78,764	61,808	901
Never Married			
Males	86,324	61,039	2,084
Females	87,148	99,655	2,134

Source: Authors' estimates.

above. The impact of HIV and AIDS can therefore be summarized as a contraction in the combinations of mental health on one hand, and spending on consumption and schooling on the other hand, which can be attained by the household, with the shift from A to D in figure 4.1 representing this direct impact. As a consequence of this shift, the household, after reallocating its expenditures, may find itself at point B, representing a lower level of utility than before. To return to its previous level of utility, it would require a transfer corresponding to the distance between points B and C (compensating variation).[16]

Table 4.13 reports the money equivalent of welfare losses in the first two columns for both measures of mental health, in terms of the compensating variation illustrated in figure 4.1. We use a married non-HIV family as the reference group because being a widow, a widower, or unmarried can be a consequence of HIV infection. The losses for each category are weighed by the sample proportions of families with children and without children to calculate the current loss to each kind of family.

Table 4.13 shows that in the case of "currently married" families, the loss (using either measure), as expected, is greatest when both members are HIV positive. The highest loss among all family types occurs for widows living with HIV and AIDS or widow-led families. For this group, the adverse impacts of HIV and AIDS are exacerbated by a drop in family income.

In the last column of table 4.13, we report the losses associated with dissaving for each type of family (again with married non-HIV families as the reference group). These are positive because of lower savings or because of increases in money transfers from relatives. We treat these as losses as they represent reductions in the material wealth of the respective households due to loss of labor income and increased medical expenditure. These losses are the highest for the unmarried families and widows.

In order to obtain estimates of the costs of HIV and AIDS for all of India, we need to "scale up" our family-level estimates. However, we only have estimates of the total number of males and females living with HIV and AIDS in India, but no breakdown across the different types of "HIV" families listed above. We therefore use our estimates to impute the loss for males and females in our sample, and then impute estimates for India, assuming that the distribution of various family types is the same as in our data. To this end, we first compute the loss to each family (depending on its type). For married couples with one infected member, widow, widowers, and unmarried individuals, we ascribe the whole loss to the infected member. For married couples where both members are infected, we split the loss equally between both members. We then add up all the losses for our sample, and derive the loss per male and per female. We then scale these up in proportion to the number of HIV-positive males and females in India.

The total loss (using IMH_1) per month is Rs. 67,601 for a male living with HIV and AIDS and Rs. 65,120 for a female (the respective figures using IMH_2 are Rs. 76,986 for males and Rs. 84,272 for females). Based on a total number of 1.55 million males and 950,000 females living with HIV and AIDS in India,[17] this implies that the loss to the male population living with HIV and AIDS in India (using IMH_1) is Rs. 104.78 billion per month, and that for the female population is Rs. 61.86 billion per month, adding up to a total of Rs. 166.64 billion per month. The total annual cost of HIV and AIDS per year, with 0.36 percent of the population affected, comes out at Rs. 1,999.8 billion (7 percent of GDP), which is more than the annual health expenditure of Rs. 1,356 billion (2004) for all ailments in India!

One obvious point of comparison for our findings is the literature estimating the costs of increased mortality. Haacker (this volume) summarizes this literature, and estimates these costs at about 3 percent of GDP for India (based on the most recent data on HIV prevalence), a similar order of magnitude (though somewhat lower) as our estimates. While it may be tempting, on the face of it, to add up these estimates of the impacts of increased mortality and our findings of the costs of HIV and AIDS based on mental health, the two approaches overlap more than it appears at first sight. First, mortality-based estimates such as the ones discussed and applied by Haacker are based on valuations of mortality risks implied by data on wages and professional mortality risks. However, these underlying estimates do not generally separate the adverse effects of the possibility of premature death and the expectation of a period of sickness; the estimated impacts of the welfare effects of increased mortality therefore also capture an increased expectation of sickness. Second, our estimates of mental health likely also capture the expectation of a premature death. Against this background, the fact that the two different approaches return broadly similar estimates of the costs of HIV and AIDS is encouraging.[18]

Concluding Remarks

Using primary household data, we estimate household utility function parameters that measure the relative importance of consumption, schooling of children, and mental and physical health effects of HIV and AIDS in India. Since mental health is not directly observable, we first compute an ordinal measure based on a series of questions following Case and Deaton (2006). Then we use an ordered probit model to obtain a continuous measure, which is then used to estimate the parameters of the family utility function. The welfare loss due to HIV is then obtained using the principle of willingness to pay to come up to the utility level of non-HIV married families, used as the benchmark.

We find that mental health effects are far more important than the effect of consumption or children's schooling in determining utility and the total welfare loss per month. The total annual loss for the entire country exceeds

India's annual health expenditure in 2004 and is 7 percent of GDP. This huge magnitude is not surprising as it includes private valuation of one's own life, as well as the loss from stigma. The additional loss due to loss of labor income and increased medical expenditure measured by the external transfers account for 5 percent of the country's health expenditure and 0.23 percent of GDP. Given that the HIV incidence rate is only 0.36 percent in India, these losses are quite staggering. Further, these losses are an underestimate since they do not take into account the long-term fall of transfers from relatives, borrowing, and sale of assets, and because we do not have any orphaned children in our sample.

Annex 4.1 Summary Statistics

	Mean	*Std Dev.*
Per capita monthly consumption (c)	1,019	1,189
Education (PS. SC)	70	170
Medical expenditure (md)	591	2,748
Family size (N)	2.9	1.38
Average physical health of family (H)	8.5	1.44
Maximum time span (ts)	2.07	1.71
Square of max time span (ts^2)	7.23	9.5
Wealth (W)	18,634	50,168
Age of child	11.6	3.5
Square of age of child	136	82
Average years of schooling of family members (*E*)	5.72	3.9
Number of children in family	3.04	1.42
Health of male member (H_m)	9.35	1.87
Age of male member (A_m)	29	14
Education of male member (E_m)	8.4	4.5
Number of school-age children (n_s)	1.04	1.24
Number of children under 6 years (n_p)	0.34	0.63
Education of female member (E_f)	5.2	4.5
Family resides in north India (D_{NORTH})	0.52	0.49
Family has female adult member (D_{FEM})	0.80	0.39
Patient lives in a joint family (D_{JOINT})	0.63	0.48
Family has at least one unemployed adult (D_{UNEMP})	0.12	0.32
Average age of adult members (Av_age)	32.4	8.7
Square of average age of adult members (Av_age^2)	1125	659

Annex 4.2 Determinants of Male Labor Supply

	Male Labor Supply (p-values)
Male wage (w_m)	–0.005 (0.603)
Male education (E_m)	–0.01 (0.198)
Female education (E_f)	0.007 (0.488)
W	0.0000006 (0.41)
Health of male (H_m)	0.0055 (0.84)
Number of school-age children (n_s)	0.02 (0.447)
D (Male member is HIV = 1)	–0.111 (0.173)
D (Unskilled laborer = 1)	0.59 (0.013)
D (Truck driver = 1)	0.77 (0.017)
D (Auto driver = 1)	0.84 (0.00)
D (Industry and factory workers = 1)	0.75 (0.00)
D (Hotel staff = 1)	0.79 (0.00)
D (Business owners = 1)	0.60 (0.04)
D (Shopkeepers = 1)	1.07 (0.00)
D (Service sector = 1)	0.65 (0.02)
D (Self-employed = 1)	0.57 (0.07)
D (Agriculture = 1)	1.58 (0.00)
D (Others = 1)	0.762 (0.00)
Number of observations	642
R^2	0.12

Source: Authors' survey and calculations
Note: Unskilled labor excludes agriculture laborers.

Notes

1. See, for example, Kambou, Devarajan, and Over (1992); Cuddington (1993a and 1993b); Cuddington and Hancock (1994); Bloom and Mahal (1997); Arndt and Lewis (2000); Bonnel (2000); and the Joint United Nations Programme on HIV and AIDS (UNAIDS 2004). Recent reviews of this literature can be found in Haacker (2004), Bell, Devarajan, and Gersbach (2006), and Corrigan, Gloom, and Mendez (2005).
2. Other papers using a similar approach include Bell (2005) and Philipson and Soares (2005).
3. Blanchflower and Oswald (2004) is the only work we are aware of that has used the coefficients of a subjective well-being equation to estimate welfare losses from incidents like divorce or unemployment. We compare our work with Blanchflower and Oswald (2004) in section 9.
4. Since an extremely small proportion of HIV patients in India get direct support from NGOs such as YRG CARE in Tamil Nadu, where the HIV families live in an HIV community, we did not survey such families even though we could have done so relatively easily.

5. In Delhi and Maharashtra, HIV patients were surveyed in the hospitals. We have home addresses of all these patients except seven for whom we have only the district. Hence in most cases it was feasible to sample non-HIV families from the same neighborhoods. In a few exceptions, the non-HIV families were sampled from neighborhoods with similar wealth levels in the same districts as the patients.
6. Since the data have not been collected to calculate prevalence, the proportions of HIV to non-HIV families should not be used to deduce prevalence.
7. We do not report current occupation data here as that is endogenous. While we do not use recall data for most of our analysis as it is unreliable, it is unlikely that the occupation before HIV detection will be misreported. Hence we use this part of the recall data.
8. While in many cases widows do not list AIDS as the reason for death of their spouse, they mention diseases like TB, which make it likely that the spouse did suffer from HIV but it was not detected.
9. We are aware that health experts are in favor of much shorter reference periods, for example last 15 days. We extended the period to pick up the fact that PLWHA do, on the average, have higher morbidity but go through periods of "normal" health and so we wanted a long enough period to pick up this difference.
10. It appears unreasonable to assume that in mainstream Indian society, not working is a choice for males, and only 6 percent of males not infected with HIV (who are less health constrained than those living with HIV and AIDS) do not work. Female labor supply is ignored because, as seen in table 4.2, 65 percent of them did not work before HIV detection in the family, and after it only a few do so.
11. Apart from labor income, in some cases, there are rental incomes, which we add to calculate total income of a family.
12. *Proportion* seems to be the right weight rather than the *total number*. Multiplying with the total number has the undesirable property that it gives undue advantage to having more children. We focus on the quality of a representative child.
13. While medical expenditures can be considered to improve health, poor health triggers higher medical expenditures. Consequently, medical expenditure and current health are negatively correlated in our sample. With our data set, we are not able to disentangle these two effects and therefore treat the current state of health as predetermined.
14. Here S stands for all the exogenous variables in the model: $S = (Y, H, N, n_s, W, \text{ts}, D_{HIV}, D_{FEM}, D_{JOINT}, \text{Av\_age})$.
15. We do not differentiate between the equivalent variation (an income loss equivalent to the welfare loss associated with the impacts of HIV and AIDS

on economic status, physical health, and mental health) and the compensating variation (a transfer that would return the household to the same utility level as it enjoyed before the onset of HIV and AIDS, because the log-linear structure of the utility function, coupled with the linear mental health specification, mean that these two measures coincide.

16. Differences in the composition of households would change the shape of the indifference curves in figure 4.1. As we find that such changes have a minor impact on our findings, figure 4.1, for illustrative purposes, abstracts from this effect.
17. This assumption is in line with the latest estimates of the total number of people living with HIV and AIDS in India (2.5 million), while assuming the same breakdown by sex as NACO.
18. Another reference point is the literature attempting to quantify subjective well-being. For example, Blanchflower and Oswald (2004) estimate large figures for welfare loss associated with adverse events. For example, they estimate that a typical individual in the United States or Britain would need US$100,000 per annum to compensate for the loss in well-being resulting from divorce. The corresponding figure for job loss for an average male is US$60,000 per annum.

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PART III

The Burden of HIV and AIDS on the Health Sector

CHAPTER 5

The Fiscal Burden of AIDS Treatment on South Asian Health Care Systems

Mead Over

Introduction

In South Asia, HIV and AIDS are less prevalent than in Sub-Saharan Africa or in severely affected countries of the Caribbean, Southeast Asia, or the Pacific Islands. The slower spread of AIDS, combined with the fact that most South Asian countries have higher per capita incomes than the most severely affected countries of other regions, suggest that the various impacts of the disease will be smaller in South Asia than in other regions. While this conclusion is generally justified with respect to the impact of the disease on economic output, poverty, or orphanhood, it does not necessarily follow with respect to the health sector, where particular features of supply and demand can magnify the impact of any given rate of HIV infection.

Our analysis is broadly divided into two main parts. The first part of the chapter takes stock of the scale of the challenge to health sectors in South Asia. This part sets out with an overview of the estimated numbers of AIDS cases and the availability of treatment in South Asia (section 2), including a review of the available evidence regarding the provision of antiretroviral therapy through public and private health services. Section 3 looks forward, providing new estimates of the costs of AIDS treatment through the year 2020 for six South Asian countries,[1] on the assumption that countries will attempt to provide universal access to AIDS treatment.

The second part of the chapter considers the implications of specific features of the supply and demand for health care in South Asia for the impact of the projected increased demand for AIDS treatment on South Asian health sectors, focusing on the roles of private vs. public health care providers. This emphasis reflects the fact that the public health systems of the South Asian region provide a much smaller proportion of their citizens' health care than do the systems of countries outside the region that are severely affected by AIDS (section 4). With the notable exception of Sri Lanka, three-quarters or more of health expenditures in the region are financed privately, and little or none of the private payments are mediated by third-party payers like insurance agencies. The fact that much of South Asia is poorly provided with public facilities or public sector health finances suggests that many of these people who would frequent public facilities in other countries will instead seek care from a nearby private practitioner, either modern or traditional.

In a context where public health services and third-party payers like insurance agencies play a relatively minor role, the high costs of ART have implications for access to such treatment and expose households to the risk of poverty. Section 5 discusses the impact of health expenditures on poverty in general, and arrives at conjectures regarding the impacts of HIV AND AIDS-related health expenditures on poverty.

Since AIDS treatment cannot be presumed to slow HIV transmission and may speed it, the usual argument for paying for such treatment with public funds is on equity grounds—that it will prevent poverty and orphanhood. However, section 6 of this chapter argues that publicly provided AIDS treatment might crowd out lower-quality private AIDS treatment, thereby preventing some negative spillovers of poor-quality treatment. The section reviews the evidence that suggests that this effect of public treatment might be sufficient to justify government support on efficiency grounds.

Finally, a concluding section summarizes the findings of the chapter, and suggests their policy implications for South Asian governments.

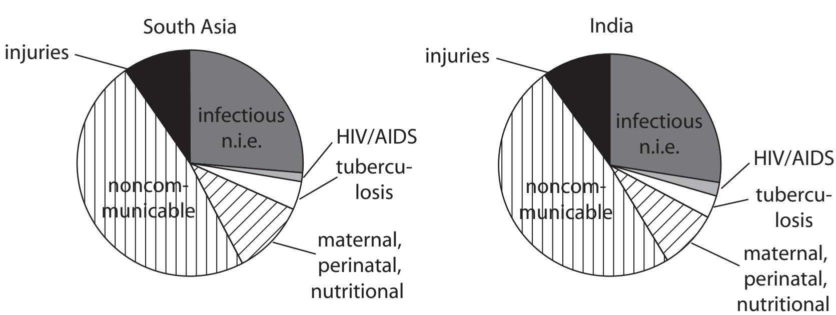
Overview of AIDS Cases and Treatment in South Asia

Knowledge of the burden of AIDS in South Asia became dramatically more precise with the release in 2006 of India's first population-based survey, which collected and analyzed blood samples in order to accurately measure the proportion of India's population that is infected with HIV. Since India is the region's largest country, the adjustment of its estimated prevalence rate from almost 1 percent early in 2006 down to approximately 0.3 percent after release of the survey has erased more than 3 million putative cases of HIV infection from the region.

In other chapters in this volume, the implications of this correction for the epidemiology and the economic impact of AIDS in India are spelled out (Haacker, chapter 3; Claeson and Wilson, chapter 1). Here it is sufficient to note that a smaller prevalence rate means that the epidemic has caused a smaller increase in the demand for health care than might previously have been conjectured. Figure 5.1 repeats Haacker's pie chart of the current burden of disease, showing that HIV and AIDS account for 1.5 percent of all deaths in South Asia and about 2 percent of all deaths in India. Haacker (chapter 3) points out that these numbers of deaths are comparable to the numbers from diabetes, tuberculosis, and measles.

What will these pie charts look like in the future? Recent evidence suggests that, in accordance with the pattern typically observed during an epidemiologic transition, measles is declining as a cause of death in the region, while diabetes and tuberculosis are both increasing. While diabetes is a lifestyle disease associated with the increasing prevalence of obesity, tuberculosis is an opportunistic illness that takes advantage of weakened immune systems, and thus can be spread by AIDS. Thus, if HIV continues to spread at the rate it has in the past, it is likely to grow to be substantially more important than measles and may outpace diabetes. Whether HIV or TB will grow faster will depend on the vigor of programs to prevent and treat them.

Figure 5.1 South Asia and India: Contribution of HIV/AIDS to Mortality



Source: Haacker (present volume).
Note: n.i.e. = not included elsewhere.

Table 5.1 Estimated Numbers of People Requiring and Receiving ART, end of 2007

	People Receiving ART			*People Needing ART*		
	Point estimate	*Lower range*	*Upper range*	*Point estimate*	*Lower range*	*Upper range*
Bangladesh	<200		<200	2,400	1,500	4,000
Bhutan	<100		<100	<100	<100	
India	158,000	138,000	178,000	. . .	630,000	1,600,000
Nepal	1,400	1,300	1,600	20,000	13,000	30,000
Pakistan	600	500	600	20,000	13,000	34,000
Sri Lanka	<200	<100	<200	780	540	1,100

Source: Adapted from World Health Organization, UNAIDS, UNICEF 2008.

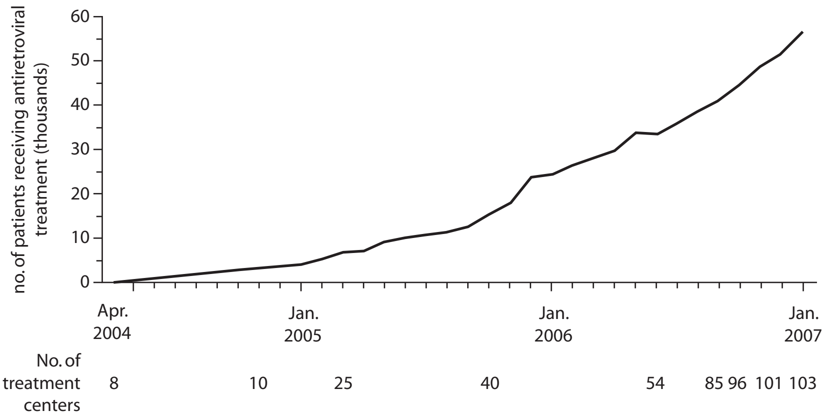
Table 5.1 presents estimates by WHO, UNAIDS, and UNICEF (2008) of the number of people receiving AIDS treatment and the number needing it but not receiving it (unmet needs) in each South Asian country. While the number of people receiving treatment is based on real, even if somewhat incomplete, data from regional health ministries, the number of people estimated to need treatment is extrapolated from epidemiologic projection models and is thus dependent on the available HIV-prevalence data.

In India, the recently announced adjustments in the estimated number of HIV-infected people give credence to the lower estimate of 630,000 needing treatment, and suggest that the upper estimate of 1.6 million is obsolete. Since the ratio of those receiving treatment to those needing it is defined as the coverage rate, the choice of 630,000 as the denominator means that India has achieved a 15 percent coverage rate rather than only a 6 percent coverage—welcome news to those striving for maximal coverage.

Figure 5.2 presents data on the scale-up of central government-financed ART to a total of about 56,500 patients in January 2007. The most remarkable feature of the scale-up depicted in figure 5.2 is its constantly increasing upward slope. Like Thailand, Botswana, and a few other countries, India has been able to accelerate its treatment program. While one can ask whether the patient numbers represent surviving patients or replacements recruited when a patient dies or is lost to follow-up, the achievement of continued acceleration over a three-year period is remarkable and sets a high standard for coming years.

Estimates for the number of patients receiving ART in India from nongovernmental sources are extremely conjectural. Steinbrook (2007)

Figure 5.2. HIV Treatment in Centers Supported by the Indian National AIDS Control Organisation, April 2004 through January 2007



Source: NACO as cited by Steinbrook 2007.

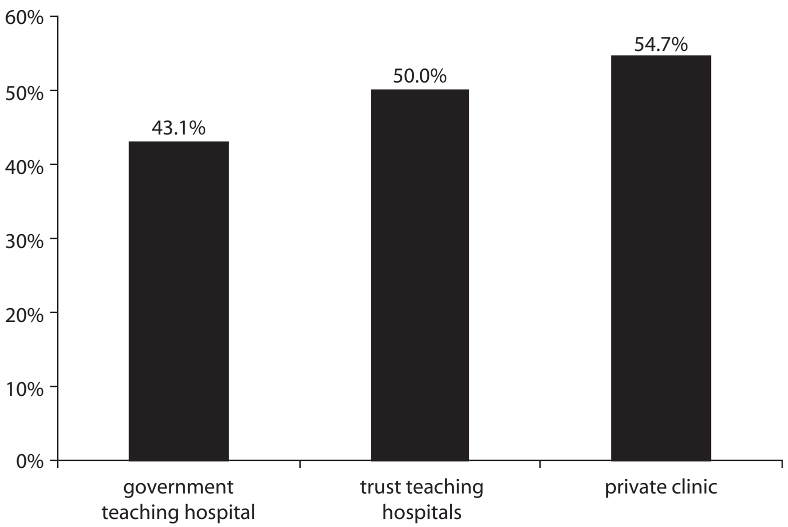
estimates they number between 10,000 and 20,000. WHO's April 2007 progress report gives an estimate of 25,000 receiving ART in the unorganized or "unstructured" private health sector (see WHO, UNAIDS, and UNICEF 2007). This brings the estimated total under treatment in 2006 to about 95,000. By December 2007, the updated WHO report estimates a total of 158,000 under treatment, including about 5,000 treated by NGOs, and 35,000 in the for-profit private sector. Thus, for two years running, the Indian government has estimated that it is treating three out of four Indian ART patients, with one out of four being treated in the formal and informal private sectors. Since the private sector provides over 80 percent of all health care in India, these estimates suggest that Indians depend much more on the public sector for AIDS treatment than they do for other health care services.

It is also possible, however, that NACO and WHO have greatly underestimated the amount of private sector provision. For example, using data from two surveys of Indian physicians, one by mail and another conducted by the representatives of a major pharmaceutical firm, a study performed in 2002 found substantial prescribing of ART among nongovernment physicians (Hira 2002). The representativeness of neither of these samples can be assured. The former suffered from a response rate of only 30 percent, while the latter was a convenience sample selected by the pharmaceutical company, which is likely to be biased toward high-volume prescribers. Within the sample collected by the pharmaceutical companies, about a third of the respondents were employed by government hospitals, while 46 percent were in private clinics, and 22 percent were in trust hospitals. Given that many of the government employees in the sample also practice part time at private clinics, this distribution plausibly represents the population of Indian physicians.

Respondents were asked whether they prescribed antiretroviral medications. Their self-reported answers were coded as "never," "occasionally," or "frequently." Figure 5.3 presents the results. Note that in 2002, the more independent the practicing physician was from any affiliation with the government, the more likely he was to prescribe ART, with the highest frequency being practitioners in private clinics. This was in 2002, before India began to expand the availability of ART with the establishment of AIDS Treatment Centers. The pattern partly reflects the fact that the pharmaceutical company was approaching and surveying its usual clients, who are probably high-volume prescribers. However, even taking this possible source of bias into account, the pattern shows that many private sector physicians were fully engaged in ART treatment.

Assuming these surveys to be representative—a perhaps heroic assumption—the authors of the study estimated that about 90,000 Indians were receiving ART in 2002, at a time when the government was

Figure 5.3 Percent of Physicians Who Report Prescribing ART "Frequently" by Type of Institutional Affiliation in India in 2002



Source: Hira 2002.

formally delivering treatment to only a few thousand patients. Thus an upper bound to the number of patients receiving ART in the private sector in 2005 is on the order of 100,000 to 200,000. Assuming that most of the patients previously treated in the private sector in 2005 remain under treatment in the private sector, then the 118,000 patients receiving government-financed ART in December 2007 are only one-third to one-half of all the Indians currently under treatment. Thus, it is safe to say that somewhere between 25 percent and 67 percent of AIDS care in India is currently being delivered by the private sector.

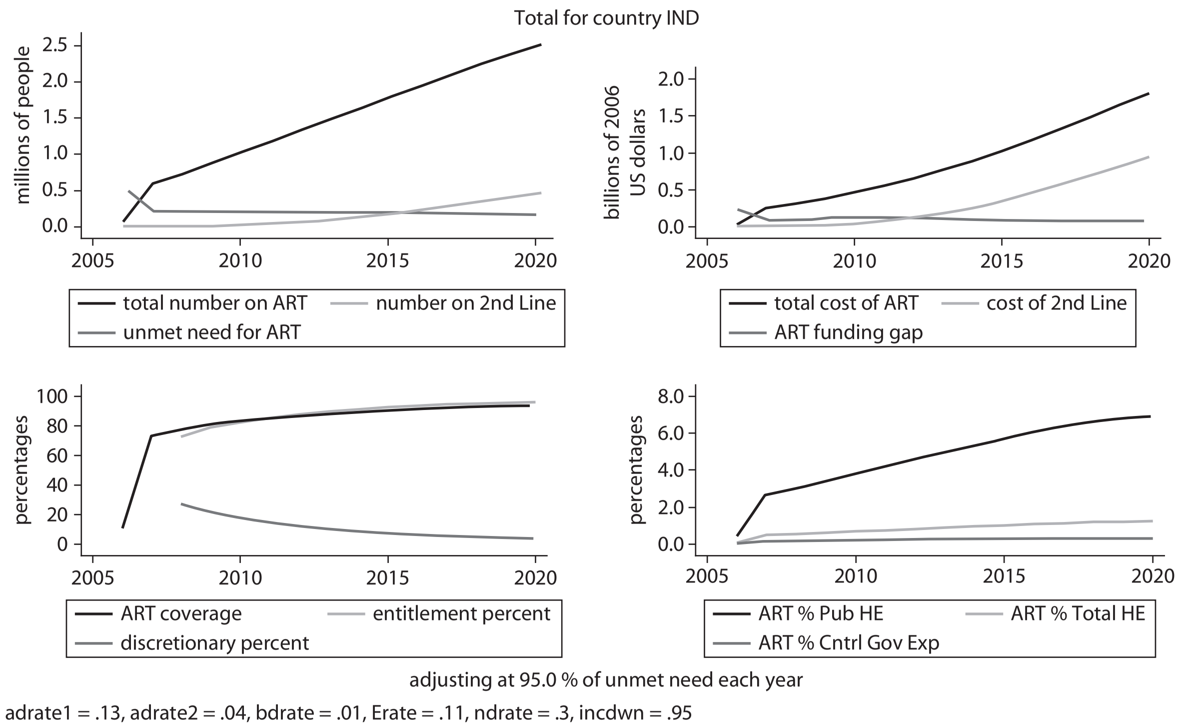
Future Growth of South Asian Treatment Costs

For patients who benefit from antiretroviral therapy, AIDS is a chronic disease. Given current technology, patients will need to take their AIDS medication every day for the rest of their lives. Thus, the fiscal and organizational burden of treating AIDS patients accumulates over time as patients who begin treatment this year are added to the stock of patients still alive from previous years.

Figures 5.4 and 5.5 present the projected burden of treatment costs for two of the South Asian countries, India and Nepal. Both figures are generated by the same model that is described in annex 3. Given assumptions regarding the success of antiretroviral therapy and the rate of new cases of HIV infection, the calculations presented in these figures are based on the assumption that all South Asian countries adopt a rapid scale up of antiretroviral therapy consistent with the ambition to achieve "universal coverage" as quickly as possible (Shrestha, Bhatta, and Bhatta 2006). The four panels in the two figures present the projected number of patients (in the northwest panel), the costs of the program each year (in the northeast corner), the percentage of the cost for those remaining from previous years, here called the "entitlement," (in the southwest corner), and the treatment cost as a percent of health and total public expenditure (southeast).[2]

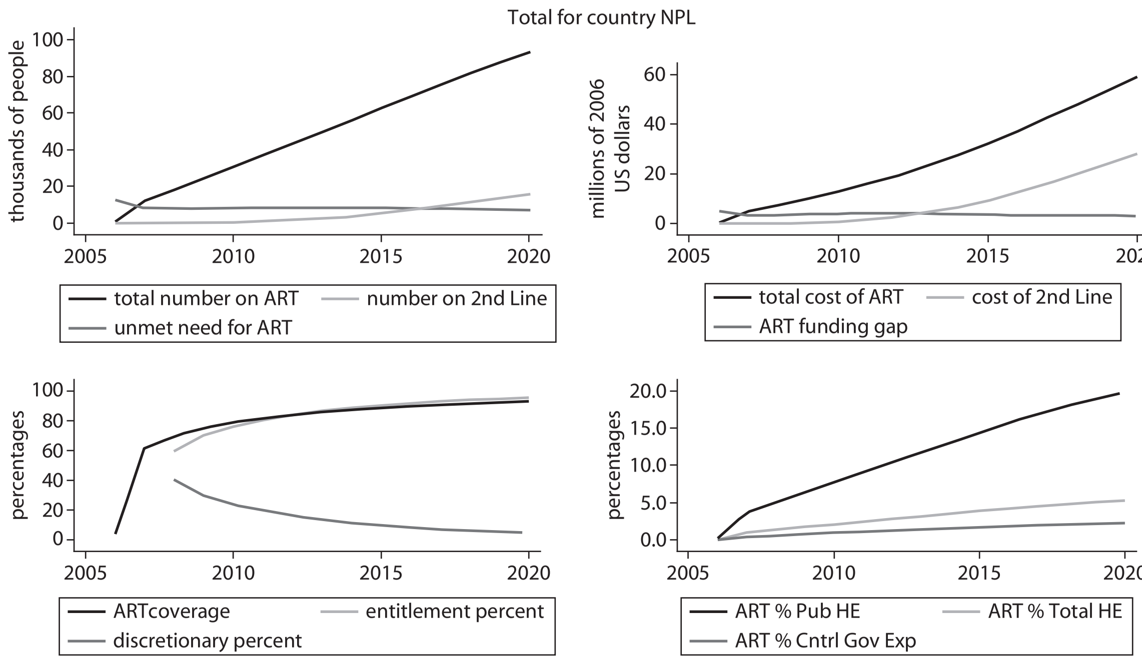
The first thing to note in comparing the figures for India and Nepal is the difference in scale, measured on the vertical axis in each of the four panels. While India's number of patients in treatment rises from less than 100,000 to 2.5 million in the year 2020, Nepal's number is 30 times smaller, rising to about 100,000 at the end of the period. Similarly the ratio between projected annual AIDS expenditures in the year 2020 also differ by a factor of 30, with India projected to spend about US$2 billion that year, and Nepal spending "only" US$60 million.

Figure 5.4 Projected AIDS Treatment Burden in India Assuming Rapid Scale Up



Source: Author's projections.

Figure 5.5 Projected AIDS Treatment Burden in Nepal Assuming Rapid Scale Up



adjusting at 95.0 % of unmet need each year

adrate1 = .13, adrate2 = .04, bdrate = .01, Erate = .11, ndrate = .3, incdwn = .95

Source: Author's projections.

Among other assumptions detailed in annex 3, the model assumes that 4 percent of those who survive one year on AIDS treatment will experience "treatment failure" each year, and then be given much more expensive "second-line" therapy. We assume that on top of a constant US$278 per year in clinic time, first-line drugs cost US$227 a year, while second-line therapy costs US$2,681. As a result of these assumptions, the projections for both India and Nepal (and for the other countries shown in annexes 1 and 2) for the portion of total costs consumed by second-line therapies are much larger than the portion of patients who receive them. (Compare the line for second-line patients in the northwest quadrant with the line for second-line patients in the northeast quadrant.) By 2020, more than 20 percent of treatment costs will be for second-line therapy, a fact that raises the urgency of efforts to bring down the cost of these more sophisticated and newer AIDS drugs.[3]

Government will also want to know what share of their various budgets will be consumed by the accumulating costs of AIDS treatment. One way to address this issue is to project forward each country's total health expenditure under the assumption that it remains the same percentage of GDP as in 2004 (the last year for which we have data). The southeast panel of the two figures shows the projections that AIDS treatment in India will rise to absorb about 6 percent of the central health budget, while in Nepal it would rise to consume about a fifth of the health care budget. Of course in both countries, the health budget might be expanded in order to absorb AIDS treatment expenditure, meaning that the major cost of AIDS treatment would be forgone funding in sectors from which the funds are reallocated.

These projections for India and Nepal both assume rapid scale-up of ART, indeed more rapid than was promised by the Indian National AIDS Control Organisation in its various announcements. At the other extreme, suppose that countries are able to maintain only the rate of scale-up that they have already demonstrated since 2004. As we saw for India in figure 5.2, this "historical" rate of expansion has been steady and accelerating, but moderate. The result will be much lower costs in the year 2020. Comparing the top and bottom rows of annex 5.4 we can see that rapid scale-up will cost about six times as much per year by 2020, compared to historical scale-up. Of course, under slower scale-up the governments will lose millions to AIDS deaths who might otherwise have had extended lives.

Annex 5.1 presents similar projections for the South Asian countries of Bangladesh, Bhutan, Sri Lanka, and Pakistan. Annex 5.2 presents a single graph for the aggregates across all the countries of South Asia (comparable to the tables in annex 5.4) and a second single graph for all of Sub-Saharan Africa. Sub-Saharan Africa as a unit is projected to be treating 30 million people by 2020, at an annual cost of US$25 billion. In the absence of assistance, AIDS treatment will be consuming about 80 percent of what would have been the health budget of the average African country. Since Africa benefits from greater inflows of grant support for AIDS treatment than does South Asia, the African governments will not be asked to cover a large share of these extraordinary costs.

Health Care Financing in South Asian Countries

Although per capita incomes are higher in South Asia than in many African countries, the two continents are on par with respect to total health expenditure per capita. Figure 5.6 presents a box and whisker plot showing the distribution of total health expenditure per capita in the six South Asian countries on the left side, and the distribution of the same variable for Sub-Saharan Africa on the right side. Although there are several outliers above the African graph, capturing the wealthiest countries

Figure 5.6 Total Health Expenditure per Capita Is Similar in Most South Asian and Sub-Saharan African Countries

Source: Author's construction from World Bank (2007).

Table 5.2 Shares of Private and Public Health Care Production in India

	1986–87		*1995–96*		*2004*	
	Rural	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*
Not treated	18	11	17	9	18	11
Treated as outpatients						
Public	26	28	19	20	22	19
Private	74	72	81	80	78	81
Treated as inpatients						
Public	60	60	44	43	42	38
Private	40	40	56	57	58	62

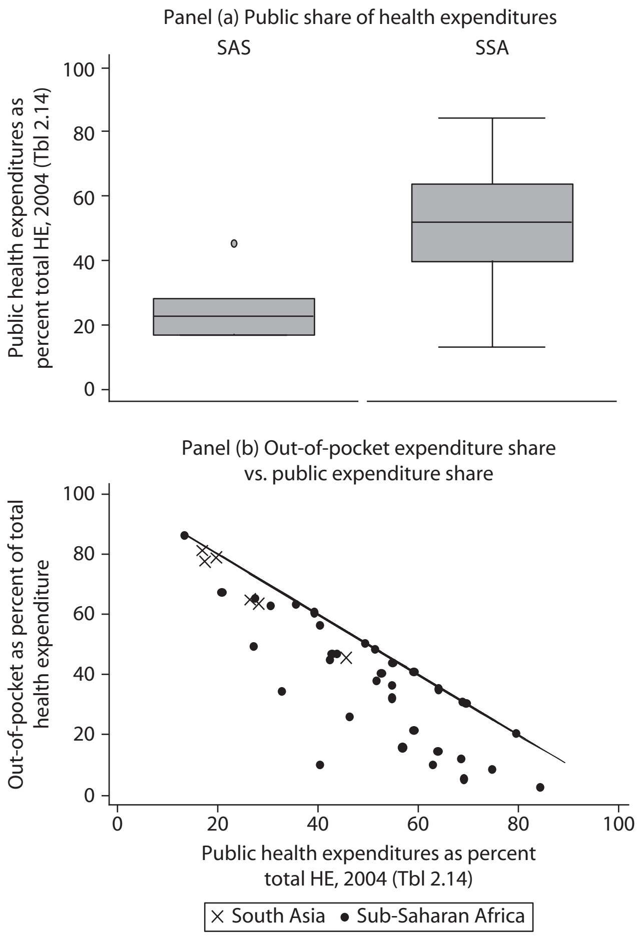
Source: Indian National Sample Survey Organization (1992, 1998) as cited in Peters, Yazbeck, and others, Better Health Systems for India's Poor, 2002, Chapter 2, Table 2.4, p. 48.

on that continent, the center of the distribution is similar in both cases, with the median for both distributions being under US$20 per person.

The importance of the private health care sector in a country can be analyzed from either the production or the expenditure perspective. Table 5.2 presents data on the production side of the Indian health sector for 1986–95. The public share of both public and private health care production clearly declined in that decade, with the private share reaching 80 percent of outpatient care and almost 60 percent of inpatient care (Sengupta and Nundy 2005). Data from the 2004 National Sample Survey shows no change in private sector dominance of outpatient care and increased private sector dominance of inpatient care.[4] In view of the growth of the private sector Indian economy since 1995 and the greatly increased inequality of the income distribution, it would not be surprising to find that the private component accounted for an even larger share of the health care sector in 2008 than it did in 2004. Since successful AIDS treatment is delivered on an outpatient basis, these data support the view that many Indian patients are likely to seek and receive ART from the private sector.

The two panels of figure 5.7 analyze the public and private roles from the expenditure perspective, comparing the South Asia region to Sub-Saharan Africa. Panel (a) of figure 5.6 shows that unlike total health expenditure, public health expenditure is distributed very differently in the two regions, with African governments being typically more generous than South Asian ones. While the median country in South Asia covers only about one-fifth of health care costs out of public money (with India covering even less and Sri Lanka much more), the median country in Africa covers about half of health expenditure.

Figure 5.7 South Asian Countries Offer Less Public Financing and Less Insurance Financing Than Most African Governments



Source: World Bank 2007.

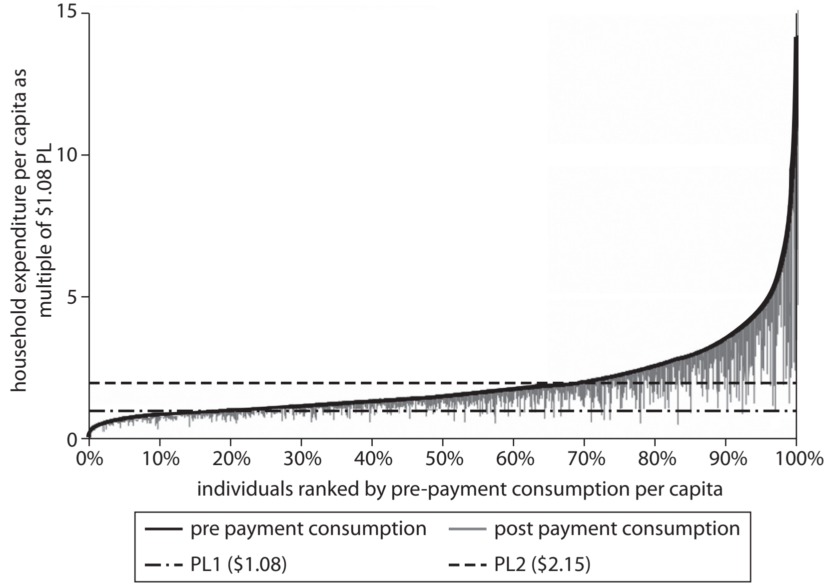
Whether low public funding makes health care accessible depends on how much of the balance must be covered by the patient out of pocket. Panel (b) of figure 5.6 shows that there is generally a negative relationship between the share of total health expenditure covered by government and the share covered by patients out of pocket for both South Asian and Sub-Saharan countries.[5] This is not surprising since the private individual's percentage contribution plus the government's percentage contribution cannot exceed 100 percent. If the government and the private person's out-of-pocket payments were the only contributors to financing health care, all of the countries in both regions would lie exactly on the straight line that is at a 45-degree angle from the two axes. The reason that the country markers are not on the downward-sloping diagonal is that some patients' costs in every country are partly covered by a "third-party payer." These "third parties" might be public or private insurance schemes or employers. The farther a country marker is to the southwest of the downward-sloping straight line, the larger the share that third-party payments assume of the total cost of medical care in that country. For example, the country that is farthest from the diagonal is South Africa, with Botswana, Zimbabwe, and Uganda also having substantial coverage of private health expenditure from third-party payers. In contrast, none of the South Asian countries benefits from more than 9 percent coverage of health care expenditure by third-party payers. Sri Lanka and Nepal have the most developed health insurance systems, covering about 8.7 percent of total expenditure. In India, the coverage of third-party payers in 2004 was only about 5.1 percent.

Access to Private Health Care and the Risk of Poverty

When a household has no access to subsidized public health care and no third-party coverage, it is completely exposed to the possibility of severe sickness episodes and the health care expenses they entail. Traditional analyses of poverty use household expenditure to gauge the household's well-being. But a household that has experienced life-threatening illness will sell assets and borrow in order to finance higher-than-normal health care expenditure. Analysis of total household expenditure per capita makes it appear that such a household is doing very well, simply because they spent a lot. Only by netting out the health care expenditure can one approximate the household's actual well-being. To the extent that South Asian AIDS patients are spending out of pocket for AIDS treatment, one can surmise that their household expenditure will be similarly inflated.

In studies of a number of European and Asian countries, Adam Wagstaff, Edie Van Doorslaer, and their co-authors have developed an interesting graphic technique for displaying the impact on poverty of sickness episodes and the consequent health care expenditure in the absence of government subsidies or insurance coverage. Figure 5.8 is reproduced from their analysis of Indian household expenditure in 2000 before the AIDS epidemic had generated many patients paying for AIDS treatment. The upward-sloping curve displays the cumulative distribution

Figure 5.8 Impact of Health Expenditure on Household Net Consumption Patterns in Bangladesh



Source: Van Doorslaer and others 2006.
Note: Vertical lines represent reductions in household expenditure per capita caused by health spending. Lines that drop below the poverty lines (blue and green lines) represent individuals pushed into poverty by health expenditure in 2000.

of household expenditure in India. The vertical axis measures the household's expenditure per member per day in multiples of the poverty line of US$1.08 per day. A second horizontal line is constructed at another less strict Indian poverty line of US$2.15 per day. The overall distribution shows that according to conventional measures, about 20 percent of the population lived in households where daily consumption was less than US$1.08 per day, and about 70 percent lived in households below US$2.15 per day.

However, these conventional calculations omit consideration of health expenditure. The downward dropping "paint drips" from the curved shape of the cumulative expenditure distribution show the effect of subtracting out-of-pocket health expenditure from total expenditure. The impact of this "correction" to the traditional measure of household well-being is dramatic for some households, bringing their net consumption per household member below one of the poverty lines. Health expenditure large enough to reduce a family to penury can be fairly classified as "catastrophic." Note that even households that would otherwise have been in the top decile of household expenditure were reduced to poverty by one of the two measures once health expenditure was netted out of their annual consumption.[6]

Figure 5.8 dramatically depicts the problem of catastrophic health expenditure in India, but unavoidably overstates the prevalence of the problem. For one of the vertical "paint drips" to be visible, the line must have a certain width. Given the horizontal dimension of the printed page, even a small number of "paint drips" will occlude the surface of the page, making it look as if virtually all households suffer substantial reductions in well-being from health expenditure. Consequently, the only way to assess the prevalence of the problem of catastrophic out-of-pocket health expenditure is to consider a table that gives the percentage of individuals whose household expenditure net of health care costs is in fact below the poverty line.

Table 5.3, which is excerpted from Van Doorslaer et al. (2004), presents the impact on poverty in four South Asian countries by analyzing household expenditure per capita net of health expenditure. In India, this redefinition of poverty would push an additional 20.6 million below the higher poverty line, and 37.4 million people below the lower one, increasing the proportion of Indians suffering from the most extreme form of poverty by 12 percent. In Bangladesh, Nepal, and Sri Lanka, health expenditure increases the number of those below the lower poverty line by 17 percent, 6 percent, and 8 percent, respectively. Although these increases in measured poverty are smaller than might be inferred from figure 5.8, they are nevertheless substantial.

Many who have sought private sector treatment for AIDS are likely to have been pushed below the poverty line. Suppose that an individual spends approximately US$365 a year out of pocket on AIDS treatment, which is enough to cover the full cost of first-line triple-drug therapy at generic prices, plus doctor visits and some laboratory tests. In a four-person household, this would add US$0.25 per member to daily health expenditures. From figure 5.7 we can see that households at about the 40th percentile of India's expenditure distribution, which had no other health expenditure, would be pushed down below the lower Indian poverty line by a single AIDS patient, to be on a par with households at the 20th percentile. Two AIDS patients in a household would severely impoverish a household that had previously been at the 45th percentile of the expenditure distribution.

Table 5.3 Poverty Head Counts: Effect of Accounting for Out-of-Pocket Payments for Health Care, Various Years

	Poverty Line of US$1.08 per Day Change in poverty head count					*Poverty Line of US$2.15 per Day Change in poverty head count*				
	*Prepayment head count**	*Postpayment head count*	*Percentage point change†*	*Number of individuals‡*	*Percentage change§*	*Prepayment head count**	*Postpayment head count*	*Percentage point change†*	*Number of individuals‡*	*Percentage change§*
Bangladesh	22.5%	26.3%	3.8%	4,940,585	16.8%	73.0%	76.5%	3.6%	4,653,875	4.9%
India	31.1%	34.8%	3.7%	37,358,760	11.9%	80.3%	82.4%	2.1%	20,638,361	2.6%
Nepal	39.3%	41.6%	2.2%	515,933	5.7%	80.4%	81.7%	1.3%	290,280	1.6%
Sri Lanka	3.8%	4.1%	0.3%	60,116	8.3%	39.1%	40.8%	1.7%	325,783	4.3%

Sources: Van Doorslaer et al. Table 4 and the Equitap project working papers.

Suppose that all of the 500,000 to 1.6 million people who are estimated to be living with AIDS in India are in households that would otherwise be above the US$1.08 poverty line, but not above the 40th percentile of the Indian income distribution. Since there were between 300 and 500 million Indians living under the US$1.08 poverty line in 2000, AIDS would increase the number of "strictly" poor by less than half of a percent. In so doing, it would increase the percentage of the population below the stricter poverty line from about 35 percent to 38 percent.

This analysis does not take into account the fact that AIDS treatment must continue for the rest of the patient's life. Most of the "paint drips" in figure 5.8 are probably associated with acute illness, not chronic illness. A household might recover its economic status after a single catastrophic expenditure depresses their net expenditure for a single year. But that same household would need more robust coping strategies to deal with a stream of equivalently catastrophic expenditure every year. To analyze chronic disease, one would need a graph like figure 5.8, which would be constructed for wealth (or "permanent income") instead of expenditure.

In order to push this analysis further, it would be useful to have information on the distribution of South Asian HIV infections across the income or expenditure distributions depicted in graphs like figure 5.8. It would be useful to know whether a poor person in South Asia is more or less likely to have HIV infection than a person of middle or higher income. Reports of mostly poor people accessing government subsidized antiretroviral therapy in the last few years can be set against anecdotes and rumors about the spread of AIDS among the relatively wealthy in Bollywood. Unfortunately, until recently there has been no population-based information available on the distribution of HIV infection by socioeconomic class in India, or indeed in almost any country in the world.[7] The fact that India's recent reassessment of the extent of HIV infection was based on a household survey offers hope that India will be able to correlate HIV infection to socioeconomic status for the first time.

Even without data on the socioeconomic distribution of HIV infection in South Asia, the absence of either a large public presence in health care delivery or significant health insurance coverage for 19 of 20 South Asian citizens renders the population unusually vulnerable to the financial risk of catastrophic health expenditures to treat AIDS. The efforts by governments in the region to assume public sector responsibility for rolling out AIDS treatment is a movement against the trend toward private sector dominance in the health care market. The next section presents projections of the growing number of patients needing treatment, and poses the question whether government-subsidized care can grow fast enough to meet all of that demand.

Quality of Private vs. Public ART

The consequences of private sector health care for AIDS are largely unknown. One view is that the newer formulations of antiretroviral drugs are so inexpensive, convenient, and easy to understand that private sector care might be as high quality as public sector care, and might extend treatment access to many people who could not otherwise obtain it in the South Asian countries. An alternative view is that private providers have insufficient incentive to ensure patient adherence to the drug regimen, without which the treatment will fail, and the patient may transmit a resistant form of HIV and then die. The worst possibility one can imagine is that private sector distribution would expand rapidly in the form of casual over-the-counter sales of a mixture of full-strength, diluted, and counterfeit antiretroviral medications, without any prescription or medical supervision. This kind of private sector expansion is a recipe for exacerbating both the spread and the cost of the AIDS epidemic. Within the complex private health care sectors in South Asian countries, there are surely examples of both adherence-maximizing and adherence-minimizing private care. The heterogeneity of private care between these two extremes remains to be determined. Of course, similar questions can also be raised about the quality of public sector care.

To the extent that private care is less successful at supporting patient adherence to ART regimes than the average public care facility, public financing of public sector ART delivery can be seen as crowding out some of the private sector care. If public sector care is less expensive to the patient than private care, and patients have at least a little knowledge of the relative merits of different service providers, the public sector care will crowd out the worst of the private care, thus preserving patient lives while stemming the development and spread of resistant strains of HIV.

The possibility that publicly provided AIDS treatment might crowd out lower-quality private care is an unusual and notable feature of public sector AIDS treatment in South Asia. Usually, when public subsidy or subsidized provision of a good or service crowds out private provision, any redistributive benefits that accrue must be weighed against the consequent efficiency losses. In this case, assuming that the public sector succeeds more than the low-quality private sector at facilitating patient adherence, the crowding out is preventing negative spillovers and is thus contributing to an improvement in efficiency. Given the right magnitudes for these various effects, crowding out could provide a sufficient justification for public financing and provision even in the absence of the distributive arguments.

Model delivery of ART includes the following essential components: (i) standardized, competency-based training of physicians in ART management; (ii) prescription of a standard triple-drug regimen; (iii) support from a multidisciplinary team, including a counselor and a nutritionist; (iv) regular clinical and laboratory-based monitoring of the patient's treatment status; (v) counseling to prevent transmission; (vi) prophylaxis for opportunistic illnesses when indicated; and (vii) diagnosis and treatment of opportunistic illnesses (Over and others 2006). Thus, the question of whether private sector delivery of ART would improve or worsen the quality of care in South Asia depends on what proportion of the privately delivered ART meets these criteria.

In previous work, this author and his coauthors have conjectured that the private sector care used by India's poorest AIDS patients would be "unstructured" in the sense that it would not typically include these seven essential components (Over and others 2004). Since the publication of that book, only a single study has been published that addresses this conjecture. Sheikh and co-authors interviewed 215 providers in Pune, India, and found that three-quarters had been consulted by HIV-infected clients. Of these, 14 percent had prescribed ART, "sometimes without adequate knowledge of the guidelines for their use" (Sheikh and others 2005).

On the other hand, it is not clear that public sector ART programs will necessarily be of higher quality. One study analyzed the treatment of 32 HIV-infected patients prior to 2004 at the B.P. Koirala Institute of Health Sciences, a major teaching hospital in eastern Nepal (Shrestha, Bhatta, and Bhatta 2006). Thirteen of these were discharged with virtually no care. Among the rest, six of the seven prescriptions to fight opportunistic infections, and all four ART prescriptions were incorrect. The authors concluded that "the care of HIV-infected patients even at a major tertiary care teaching hospital in Nepal was sub-optimal." Since the Nepalese government has invested in the expansion of ART since 2003, a new study would hopefully reveal substantial improvement.

In a study of the quality of the delivery of general outpatient medical services (where there was no HIV diagnosis), Das and Hammer found that quality was extremely variable in the public as well as the private programs (Das and Hammer 2004). But deviations from best practice care occurred in different directions and for different reasons in the two sectors. According to the authors, "in the public sector providers are more likely to commit errors of omission—they are less likely to exert effort compared with their private counterparts. In the private sector, providers are prone to errors of commission—they are more likely to behave according to the patient's expectations, resulting in the inappropriate use of medications, the overuse of antibiotics, and increased expenditures."

Both types of errors, of omission or commission, threaten the quality and therefore the success of AIDS treatment in India. Either can lead to early treatment failure for the patient and transmission by the patient of a drug-resistant strain of HIV to someone who consequently requires much more expensive second-line or salvage drug therapy. Thus, a government that is committed to providing subsidized AIDS treatment to all has an important role to play in assuring minimum quality standards for AIDS care in the private as well as the public sector.[8]

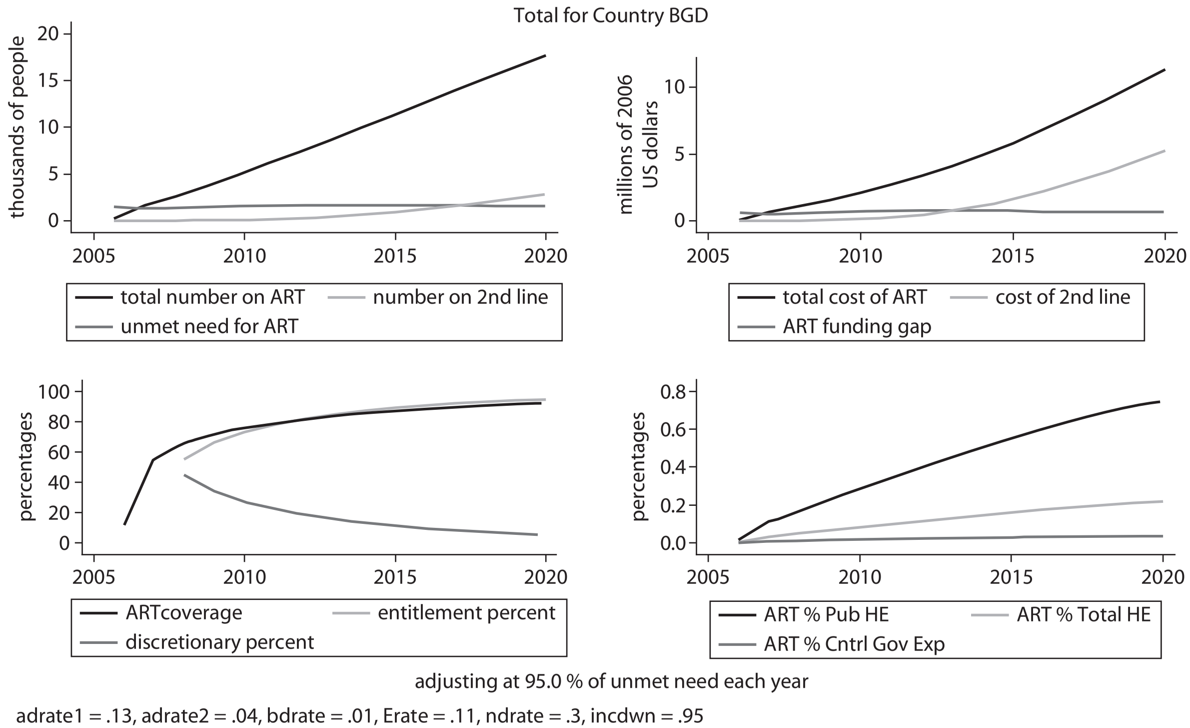
Conclusions

To the extent that patients seek out and obtain good-quality AIDS treatment from the private sector, South Asian governments can achieve the benefits of rapid scale-up without directly bearing the costs. However, it is difficult to project what the share of private treatment is now or will be in the future. If HIV infections are evenly distributed across the range of South Asian living standards, then only 30 percent of the cases would be above the more generous poverty line of US$2.15 given in figure 5.8. And the poorest 10 percent of these (the third decile of the expenditure distribution) would be pushed down into poverty by AIDS treatment expenditures. Under these assumptions, only 20 percent of AIDS patients could afford to pay for treatment without becoming impoverished. Without government subsidy, AIDS treatment would be beyond the reach of 80 percent of patients.

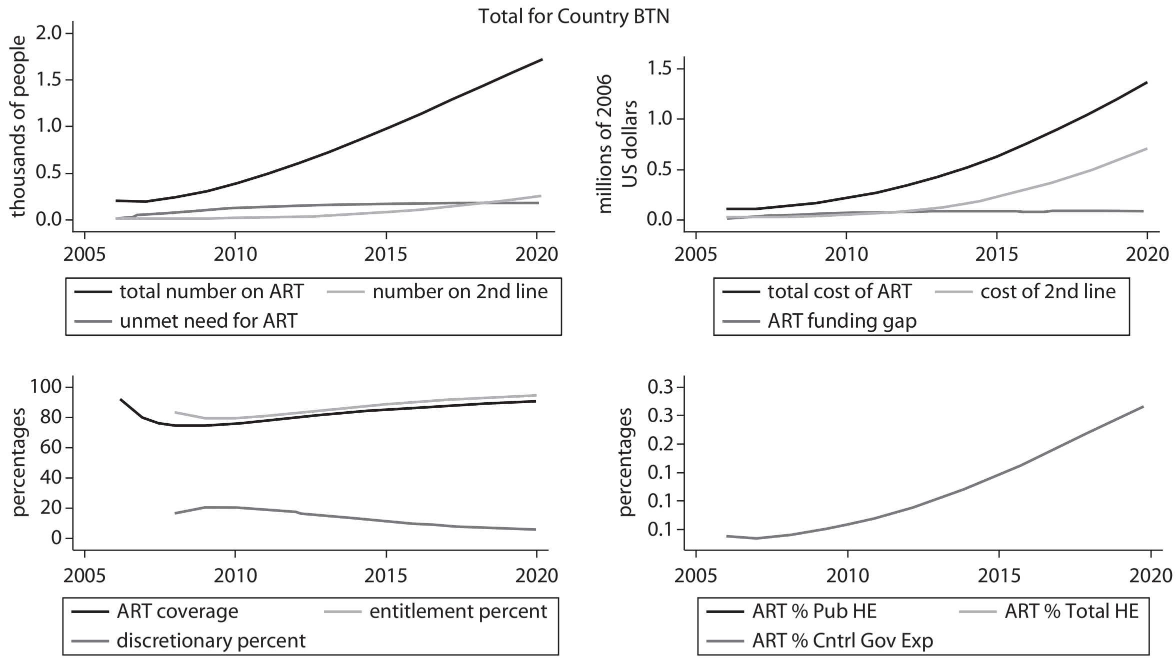
Against this background, the South Asian governments have three choices. They can strive to meet the goal of universal access as best they can with public delivery of ART. This policy will lead to the greatest expansion in costs and incidentally will swim against the current of the increasing privatization of South Asian health services.[9] They can allow the expansion of private AIDS care for those who can afford it, while trying to reduce its cost and assure its quality. Or they can use the AIDS epidemic as one more incentive to push for greater health insurance and other third-party payment of health care costs. The latter policy would be difficult to follow in a population with extremely high prevalence rates, because AIDS treatment is an expensive risk and would raise issues of adverse selection. But a policy to expand health insurance that includes coverage of AIDS treatment may succeed in India and other South Asian countries where an HIV-positive diagnosis is still relatively rare.

Whether or not the South Asian governments decide to explicitly encourage the private sector in AIDS care, they have a fundamental responsibility to collect data on the quality of private AIDS care as it occurs, beyond the easy observation of government health workers. Only through data collection on private AIDS care will it be possible to gauge the severity of the quality difference between the local public and private delivery systems. Since private providers may have little incentive to retain clients over the many months and years required for treating this chronic illness, regulation of the private AIDS treatment sector is recommended. Depending on the findings of such a data collection and monitoring project, the government could decide to accelerate public provision (in order to crowd out the lowest end of the AIDS care spectrum) or to develop explicit strategies for delegating a part of the care burden to the private sector. It might be necessary to do both, each with a different segment of the private market.

Annex 5.1 Projected Fiscal Burden of AIDS Treatment in Four South Asian Countries

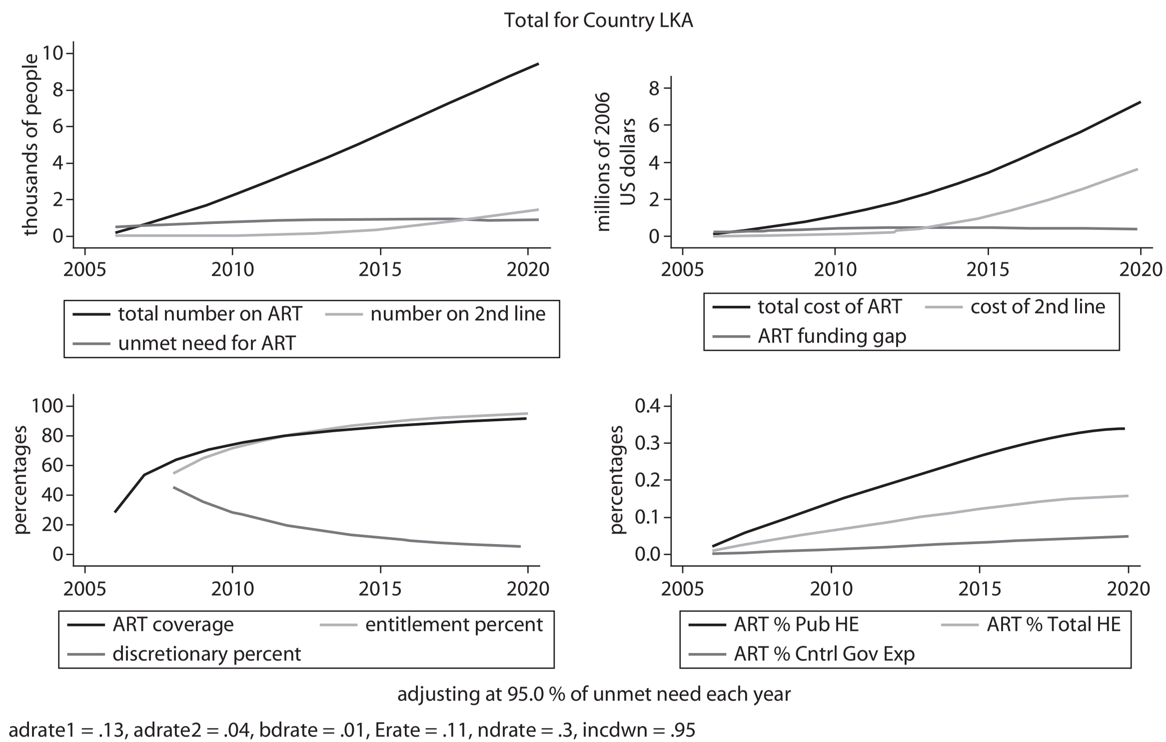


Annex 5.1 Projected Fiscal Burden of AIDS Treatment in Four South Asian Countries *(continued)*

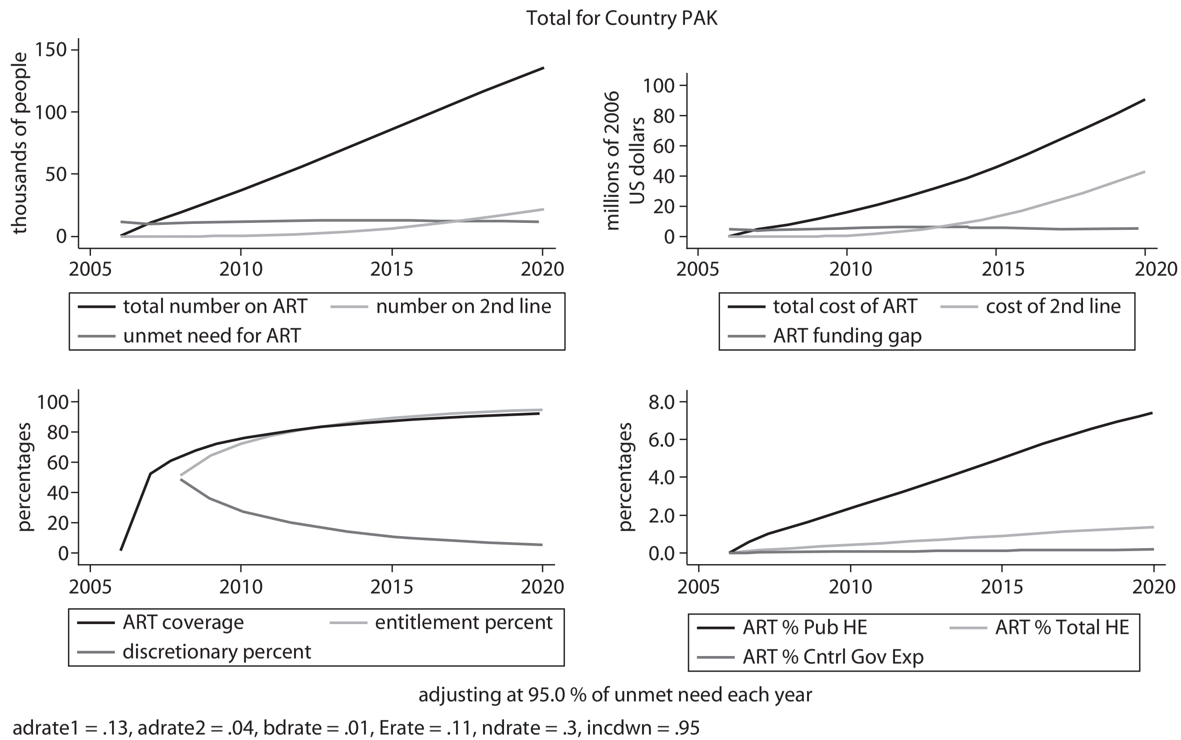


adjusting at 95.0 % of unmet need each year

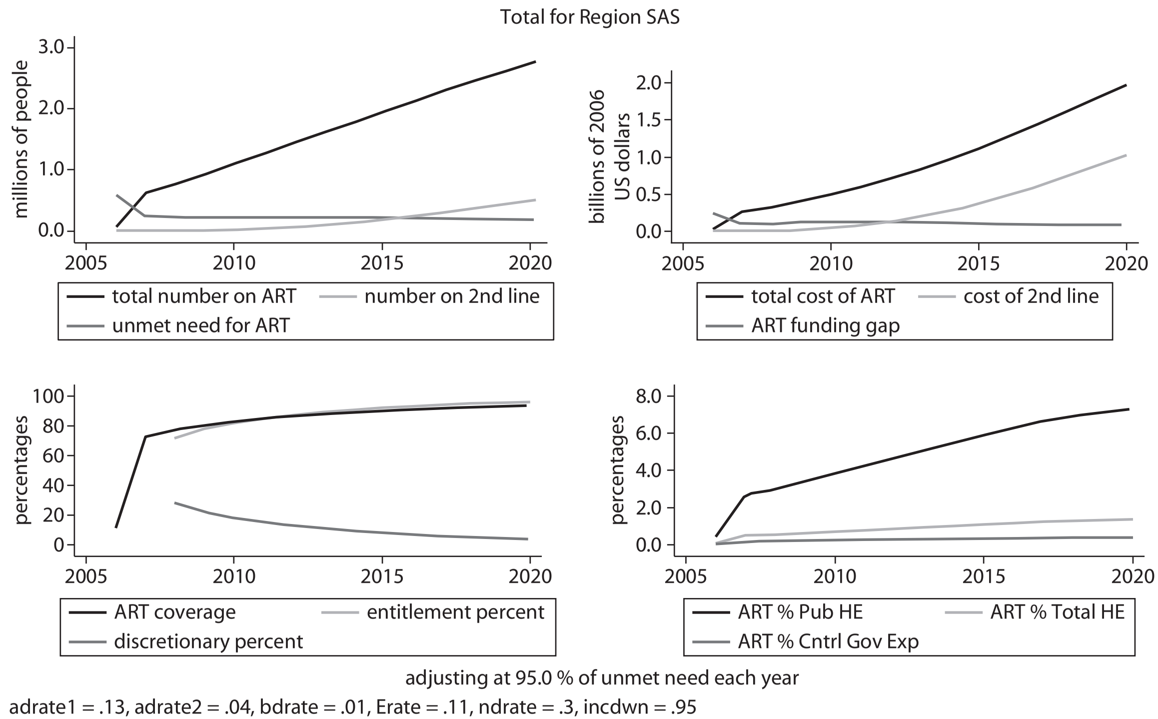
adrate1 = .13, adrate2 = .04, bdrate = .01, Erate = .11, ndrate = .3, incdwn = .95


Total for Country LKA
thousands of people
10
8
6
4
2
0
2005
2010
2015
2020
total number on ART
number on 2nd line
unmet need for ART
millions of 2006
US dollars
8
6
4
2
0
2005
2010
2015
2020
total cost of ART
cost of 2nd line
ART funding gap
percentages
100
80
60
40
20
0
2005
2010
2015
2020
ART coverage
entitlement percent
discretionary percent
percentages
0.4
0.3
0.2
0.1
0.0
2005
2010
2015
2020
ART % Pub HE
ART % Total HE
ART % Cntrl Gov Exp
adjusting at 95.0 % of unmet need each year
adrate1 = .13, adrate2 = .04, bdrate = .01, Erate = .11, ndrate = .3, incdwn = .95

Annex 5.1 Projected Fiscal Burden of AIDS Treatment in Four South Asian Countries *(continued)*

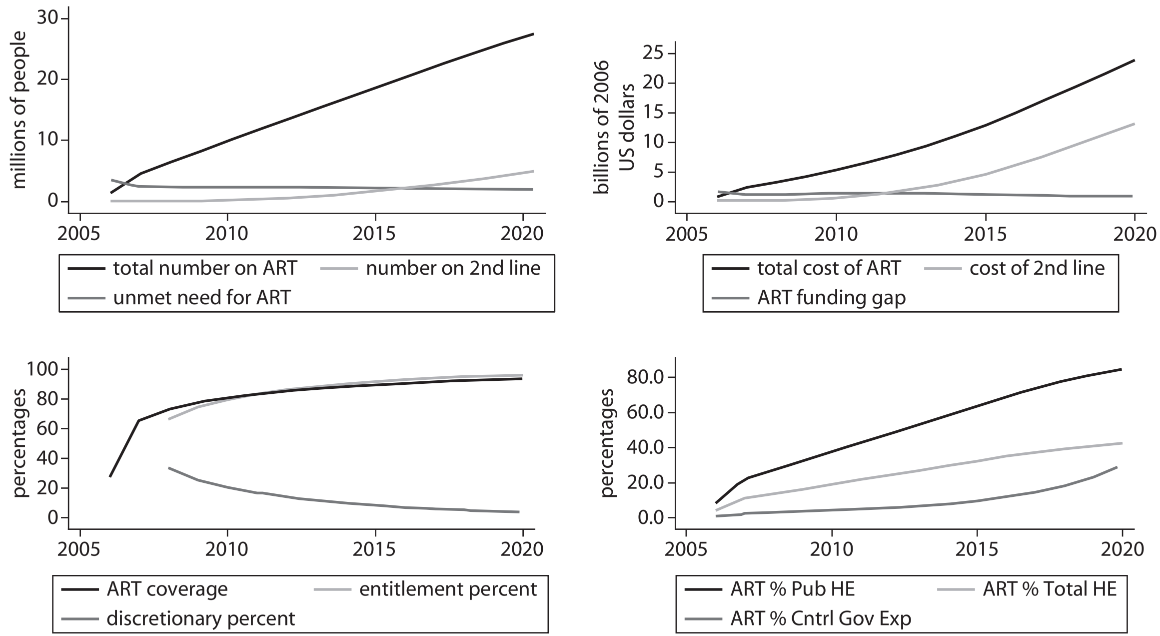


Annex 5.2 Projected Fiscal Burden of AIDS Treatment for South Asia & Sub-Saharan Africa



Annex 5.2 Projected Fiscal Burden of AIDS Treatment for South Asia & Sub-Saharan Africa *(continued)*

Total for Region SSA



adjusting at 95.0 % of unmet need each year

adrate1 = .13, adrate2 = .04, bdrate = .01, Erate = .11, ndrate = .3, incdwn = .95

Annex 5.3. Model for Projecting Future AIDS Treatment Costs[10]

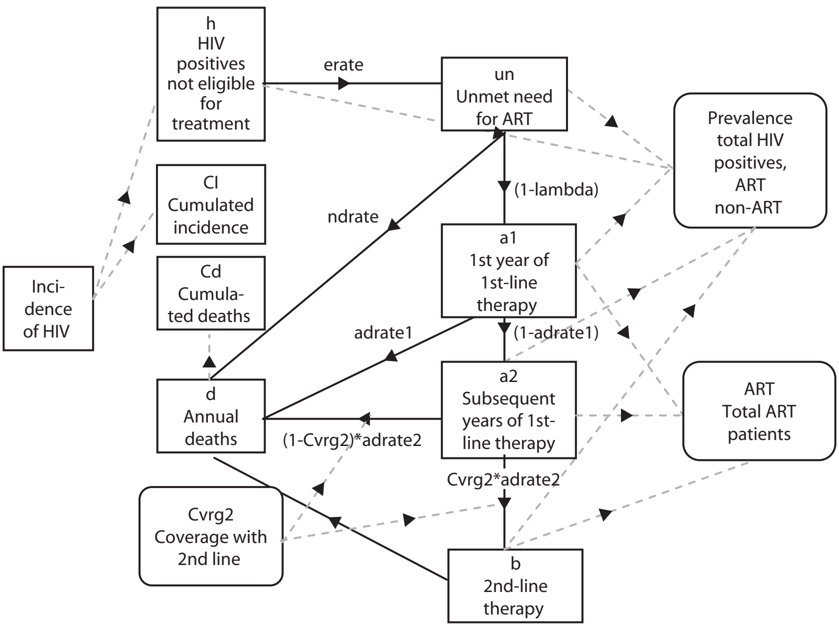
Projections of future treatment costs were made using a simple difference equation model based on those used in previous modeling studies of AIDS treatment in India (Over et al. 2004) and Thailand (Over et al. 2006). The prototype model was developed using Modelmaker from ModelKinetix (http://www.modelkinetix.com/) and then ported to STATA. The STATA code is available from the author on request.

The following figure provides a flow diagram of the model's difference equations as implemented by the STATA program *aidsproj.ado*. The dark lines with arrowheads indicate flows from a source to a sink. Parameter names close to those arrowheads are defined below the figure. Most of them are annual rates of flow expressed as proportions of the source population that move towards the sink in a single year. However, the parameter "Cvrg2" represents the proportion of patients needing second-line therapy who gain access to it in a given year. The runs of the model reported here assume that coverage with second-line therapy starts at 5 percent of those needing it in 2006 and levels off at 95 percent of those needing it in 2016.

Parameters of the *aidsproj* projection model

Proportion of HIV+ newly eligible for ART	erate	0.11
ART death rate during first year on 1st line	adrate1	0.13
ART failure rate during subsequent years on 1st line	adrate2	0.04
ART death rate of AIDS patients on 2nd line	bdrate	0.01
Non-ART death rate of AIDS patients	ndrate	0.3
Starting coverage rate for 2nd-line ART[11]	strtcov2	0.05
Target coverage rate for 2nd-line ART	trgtcov2	0.95
2nd-line ART to reach target in year	trgtyr	2016
Scale up of 1st-line modeled as constant proportion (1 - lambda) of unmet need, where lambda is constant across all countries and equal to:		
Historical scale-up	lambda =	0.82
Rapid scale-up	lambda =	0.05
Annual cost per patient of first-line drugs[12]		US$227
Annual cost per patient of second-line drugs		US$2,681
Annual cost per patient of clinic time		US$278

Annex 5.3 Flow Diagram for *Aidsproj* Model Predicting the Future Growth of AIDS Treatment Cost



Annex 5.4 Projected Annual Cost of Treating AIDS Patients in Six South Asian Countries by Uptake and Prevention Scenarios

	1st Line	*2nd Line*	*Total Cost*		*1st Line*	*2nd Line*	*Total Cost*
Costs of AIDS treatment at historical uptake with effective prevention (90% reduction in incidence each year)				*Costs of AIDS treatment at historical uptake with moderate prevention (5% reduction in incidence each year)*			
2006	26,991	7,673	34,664	2006	26,991	7,673	34,664
2007	40,188	8,071	48,259	2007	40,188	8,071	48,259
2008	52,467	9,102	61,569	2008	52,467	9,102	61,569
2009	64,405	11,313	75,718	2009	64,405	11,313	75,718
2010	75,425	15,087	90,512	2010	76,001	15,087	91,088
2011	85,236	20,780	106,016	2011	87,218	20,780	107,998
2012	93,718	28,679	122,397	2012	98,019	28,734	126,753
2013	100,865	38,979	139,844	2013	108,363	39,270	147,633
2014	106,732	51,806	158,538	2014	118,206	52,677	170,883
2015	111,410	67,205	178,615	2015	127,511	69,213	196,724
2016	115,008	85,176	200,184	2016	136,255	89,109	225,364

Annex 5.4 Projected Annual Cost of Treating AIDS Patients in Six South Asian Countries by Uptake and Prevention Scenarios (2006 U.S. dollars) (continued)

	1st Line	*2nd Line*	*Total Cost*		*1st Line*	*2nd Line*	*Total Cost*
Costs of AIDS treatment at historical uptake with effective prevention (90% reduction in incidence each year)				*Costs of AIDS treatment at historical uptake with moderate prevention (5% reduction in incidence each year)*			
2017	117,630	103,798	221,428	2017	144,420	110,451	254,871
2018	119,396	122,889	242,285	2018	151,987	133,122	285,109
2019	120,401	142,267	262,668	2019	158,953	157,014	315,967
2020	120,747	161,774	282,521	2020	165,319	182,005	347,324
			Least costly				
Total	1,350,619	874,599	2,225,218	Total	1,556,303	933,621	2,489,924
Costs of AIDS treatment at rapid uptake with effective prevention (90% reduction in incidence each year)				*Costs of AIDS treatment at rapid uptake with moderate prevention (5% reduction in incidence each year)*			
2006	26,991	7,673	34,664	2006	26,991	7,673	34,664
2007	258,193	8,071	266,264	2007	258,193	8,071	266,264
2008	319,797	9,102	328,899	2008	319,797	9,102	328,899
2009	388,257	23,025	411,282	2009	388,257	23,025	411,282
2010	445,754	46,425	492,179	2010	455,046	46,425	501,471
2011	492,955	81,134	574,089	2011	519,393	81,134	600,527
2012	531,116	128,198	659,314	2012	580,896	129,118	710,014
2013	561,384	188,133	749,517	2013	639,259	192,155	831,414
2014	584,774	261,115	845,889	2014	694,262	271,843	966,105
2015	602,187	347,036	949,223	2015	745,756	369,568	1,115,324
2016	614,414	445,581	1,059,995	2016	793,646	486,518	1,280,164
2017	622,159	546,294	1,168,453	2017	837,891	611,374	1,449,265
2018	626,036	648,227	1,274,263	2018	878,483	743,426	1,621,909
2019	626,595	750,576	1,377,171	2019	915,451	881,967	1,797,418
2020	624,316	852,648	1,476,964	2020	948,854	1,026,292	1,975,146
							Most costly
Total	7,324,928	4,343,238	11,668,166	Total	9,002,175	4,887,691	13,889,866

Source: Author's calculations based on assumptions in annex 5.

Notes

1. Owing to data constraints, the analysis presented in this chapter focuses on Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka, and excludes Afghanistan and the Maldives.
2. Figures 5.4 and 5.5 share the assumption that the "incidence rate" of new cases declines at a modest 5 percent each year from its historical level. This assumption is also embodied in the two right-hand tables in annex 4.

3. The greatest uncertainty in these projections is with regards to the annual cost of second-line therapy. While the costs of clinic time and of first-line therapy are unlikely to change much, second-line therapy could either decline or increase in average cost. Second-line prices might decline due to negotiated price reductions and/or exercise of Trade Related Aspects of Intellectual Property Rights provisions, which allow a country to issue a "compulsory license" for domestic manufacture of a pharmaceutical product under certain conditions. But there will be upward pressure on second-line costs from the advent of newer medications, the increasing complexity of care for patients who fail first-line treatment, the usual increase in costs with increasing scale, and the globalization of the Indian pharmaceutical industry. Since the outcome of these conflicting trends is not clear, the projections presented here assume that unit costs remain constant for both first- and second-line medications.
4. Thanks to an anonymous reviewer for supplying the 2004 figures for this table. The data are advertised on the Web site of the statistical office at http://mospi.nic.in/mospi_nsso_data.htm.
5. To a different degree in each country, the cost of both AIDS and non-AIDS care is currently underwritten by donors. For example, according to India's NACO, the government of India covers 60 percent of NACO's budget out of either direct budget support or a credit from the World Bank. The remaining 40 percent of NACO's expenditures was funded by grants from DFID, the Global Fund to Fight AIDS, Tuberculosis and Malaria, and USAID. (http://www.nacoonline.org/About_NACO/Funds_and_Expenditures/)
6. The situation is a bit more complex than presented in the text. Since people have insurance and precautionary saving, some out-of-pocket payments are prefinanced and therefore should not be seen as immiserating. This prefinanced proportion of the out-of-pocket payment should instead be subtracted from both gross and net consumption. In figure 5.8, this would have the effect of shifting an individual "paint drip" to the left and also making it shorter. If the slope of the cumulative expenditure curve is sufficiently flat (i.e., less than 45 degrees), such a shift could move an individual who appears to be immiserated by health care expenditures to a position from which health expenditure no longer Pushes him or her below the poverty line. See Van Doorslaer, Wagstaff, and co-authors for in-depth discussion (Van Doorslaer et al. 2007; Van Doorslaer, Wagstaff, and Rutten 1993; Wagstaff 2002; Wagstaff, Van Doorslaer, and Paci 1989).
7. The incorporation of blood tests into the Demographic and Health Surveys financed by USAID has permitted such analysis for the first time in a dozen or so countries, none of which is in Asia. http://www.measuredhs.com/topics/biomarkets/start.cfm

8. High-quality AIDS treatment will not only maximize adherence, and thus patient survival, but will also minimize transmission in the community through outreach programs. Potential mechanisms to achieve this goal are discussed in Over and others (2006) and Over and others (2007).
9. A reviewer points out that the government of India has recently committed to increasing health expenditure from its present 1 percent of GDP to 2 percent to 3 percent of GDP by 2012. This paper shows that expansion of AIDS treatment could potentially absorb all of such an increase.
10. See the Spectrum projection model for an alternative approach: http://www.futuresinstitute.org/.
11. The model embodies the assumption that, for those people who fail first-line ART, access to second-line ART expands along a logistic curve from about 5 percent of all patients needing it now to 95 percent of all patients needing it in 2016.
12. Drug costs are assumed to vary across countries with the 2006 GDP per capita of the country according to the patterns observed by WHO in that year, and then to remain constant (in constant dollars) in any given country over time. While the costs of drugs may be reduced as markets for antiretroviral drugs become more contestable, the unit costs of achieving high ART uptake and strong adherence may increase at the same rate, leaving average costs per patient unchanged.

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CHAPTER 6

Recurrent Costs of India's Free ART Program

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In April 2004, the government of India announced the Free Antiretroviral Treatment (ART) Program, which brought first-line antiretroviral (ARV) drugs within the reach of a much larger pool of ARV-eligible individuals. However, the full costs of providing treatment, the share of costs across entities involved directly or indirectly in the program, and the possible financial implications of a more scaled-up program were not much discussed or analyzed in the country, leaving open many questions regarding the cost of the program and the implications of scaling up access to treatment. The present study attempts to fill this gap by carrying out a financial analysis of the recurrent costs of the ART program of the government of India, with a view to understanding the per-client cost of provision of ART by the government, the share of various components of the program in total cost, the distribution of costs across the different bearers of such costs, the resource implications of scaling up, and the long-run sustainability of the program.

Introduction

The availability of antiretroviral drugs at reduced cost and the example of large-scale antiretroviral treatment programs in countries like Brazil have spurred many other developing countries to start their own ARV treatment programs, including India, which launched its Free ART Program in April 2004, with the objective of expanding access to antiretroviral treatment, initially in high-prevalence states, and with the plan to subsequently expand to other states.

This chapter discusses the financial implications of scaling up the Free ART Program, and of expanding it on an all-India basis. Most of the analysis focuses on estimating unit cost data, which are critical for estimating the resource needs, and for any analysis of cost-effectiveness and impact evaluation. Comprehensive estimates of the costs of treatment with ARV, in sufficient breadth and detail to allow for such a scaling-up exercise, were not available so far, either in the public or in the private sector.

The only study of the costs of ARV treatment in India is a recent one by Bhat and Saha (2006), which uses an incremental cost approach to calculate per-client cost of providing ART for a site in Gujarat, and arrives at a figure of Rs. 668 per month. However, these calculations are based only on the direct provision of ART and do not take into account other shared costs incurred by the different departments of the hospital. To that extent, this figure underestimates the per-client cost, although it provides a very useful benchmark for which to compare our results.

From the perspective of the government, however, it is crucial to obtain estimates of such overhead costs, to understand the total recurrent costs at present, to know how the burden is distributed among different entities, and to understand the feasibility of sustaining the program over the years. In particular, it is important to understand the extent to which core government funds are being spent to sustain the program, as a significant part of the costs of running the program is being borne by the (government-funded) hospitals that are actually treating the patients. In order to fully understand the financial costs of India's Free ART Program, and to effectively plan and implement the program, it is important to understand the actual financial distribution of the costs. Understanding the full costs is also necessary to assess the feasibility and sustainability of an ARV treatment program.

Another objective of the costing exercise is to understand the component of total cost that is borne by individuals. This is important not only from a financial perspective, but also in terms of the potential impacts of HIV and AIDS on the household level. As will be shown below, the "free" program does not imply that the entire ARV treatment is free; individuals bear a significant burden of accessing ART, which needs to be analyzed to understand whether such costs impose a barrier to the available treatment.

The present study thus attempts a full financial analysis of the recurrent costs of the ART program of the government of India, with a view to understand the following:

- The per-client cost of provision of ART by the government
- The share of various components of the program in total cost
- The distribution of costs across the different bearers of such costs
- The resource implications of scaling up and the long-run sustainability of the program.

The study was completed in consultation with the National AIDS Control Organisation (NACO)[1], which also helped in selection of the study sites. In addition, in each of the sites, the hospital staff and the concerned State AIDS Prevention and Control Societies (SACS) offices were actively involved in facilitating the research and data collection.

The chapter is organized along the following lines: At the outset, we provide some background on India's Free ART Program. The analysis then proceeds broadly in three main steps. First, we discuss the methodology and the process of data collection, and present information on the various sites where the study has been conducted. Second, we outline the key assumptions and parameters underlying our unit cost estimates, and present our estimates of unit costs of treatment and of out-of-pocket expenditures associated with care and treatment. Third, we provide estimates of the aggregate costs of India's Free ART Program, and discuss how these would change as the number of patients increases or as the prices of key components of treatment change. Finally, a discussion of findings highlights some of the key results of our study, and a concluding section discusses how these findings may help guide policy makers and stakeholders in planning and implementing India's Free ART Program.

India's Free ART Program

While the exact number of infected individuals in the country is subject to debate, NACO estimates indicate that currently there are approximately 5.2 million people living with HIV and AIDS in India (NACO 2006). In response to the epidemic, NACO is implementing a comprehensive program comprising targeted interventions for groups at high risk, preventive interventions for the general community, low-cost AIDS care, institutional strengthening, and intersectoral collaboration.

Until 2003, access to ART in India was quite limited; it was estimated that out of 750,000 ART-eligible individuals in need of treatment, only 13,000, or 2 percent of the total, were receiving ART by the end of 2003. At that time, ART was delivered mainly through the private sector. Although ARVs were also provided in the public sector through various government institutions like the Central Government Health Scheme (CGHS), Employees State Insurance Corporation (ESIC), the Armed Forces Medical Services, and the railways, these arrangements were not systematic or by design, and were in place mainly as part of medical benefit schemes in these government organizations. Clearly, there was only very limited access to ARVs in the country till 2003, with most of the individuals requiring ART accessing private providers, who were more likely offering "unstructured" ART (Over et al. 2004). The health financing situation in the country continued to present a somewhat bleak scenario, with total health expenditure at about 5.2 percent of GDP, of which only 1 percent was from the government sector (World Bank 2001). Many studies corroborated the fact that the major part of health expenditure in India was on curative care, and it was financed mostly out of pocket (Ministry of Health and Family Welfare (MoHFW) 2005). Given the high level of sustained financing required for ART, as well as the limited access to drugs, it was clear that ART was neither affordable nor available to a vast majority of infected individuals, who were already reeling under significant out-of-pocket expenditure for other health issues. Most important, with ART being offered by the unregulated private sector, where adherence and monitoring were serious issues, the situation was ripe for an intervention like the subsequent government program.

Thus, with domestic and international pressures to respond to the increasing treatment need—and despite concerns raised around the ability of the health system to handle a complex therapy like ART—the government, on the eve of World AIDS Day 2003, announced its program of free distribution of ARVs in selected states. In June 2004, the Global Fund on AIDS, TB, and Malaria (GFATM) awarded a financial grant of US$165 million to provide ART in the public sector and through public-private partnerships to 100,000 people living with AIDS over a five-year period (see http://www.nacoonline.org/directory_arv.htm).

As announced by the then-health minister, the actual plan aimed at not only providing free antiretroviral treatment to 100,000 people living with HIV and AIDS by the end of 2005, but to provide treatment to an additional 15 percent to 20 percent of AIDS cases each year thereafter, for a period of five years. The rollout started in April 2004, and covered three groups: women covered under the Prevention of Parents To Child Transmission (PPTCT) program, children below 15 years of age, and AIDS patients who seek treatment in public sector hospitals. The program was started in the six high-prevalence states of Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka, Manipur, and Nagaland, and in the capital city of Delhi. Recent reports indicated that NACO was aiming to expand the ARV rollout to 100 centers—with at least one site in each state—by the end of 2005.[2]

The program was put in place in government hospitals and medical colleges, without much interaction with the state health departments. Since it was being run as a central program, the state health departments were not actively taken on board for planning purposes, though the funding for the hospitals came from these departments. Instead, the SACS, which were running the prevention and control program in the states, were made the focal points of the treatment program. The national guideline for implementation of ART was formulated and distributed across the ART centers. Attempts were made to strengthen the health system through capacity-building measures for treating physicians, and each ART site was given some startup financial help.

According to NACO, currently there are about 39,000 patients on ART, of whom more than 76 percent access ART from NACO-supported ART centers. In addition, as table 6.1 shows, there are other sites where ART is offered for free, with the major ones being in the NGO sector (about 10 percent). The private sector covers about 6 percent of ART patients currently on treatment in India. In all, there are currently 54 NACO-supported ART sites all over the country, with 39 in high-prevalence states with

Table 6.1 Clients Receiving ART in India's Free ART Program (as of March 2006)[3]

Sites	*Number of sites*	*Number of clients*	*Proportion (Percent)*
NACO-supported ART centers-GFATM states	39	23,773	61.1
NACO-supported ART centers-Non-GFATM states	15	5,973	15.3
State-supported ART centers	9	766	2.0
NGO-supported ART centers	2	3,699	9.5
Intersectoral partners	4	2,327	6.0
Private partners	2	2,399	6.2
Total	71	38,937	100

Source: NACO 2006.

GFATM-supported programs (Tamil Nadu, Maharashtra, Andhra Pradesh, Karnataka, Manipur, Nagaland, and Delhi). Another 15 sites are in medium- to low-prevalence states that are not being funded through the GFATM grant.

Methodology and Data Collection

The unit cost of any intervention is measured as the total cost divided by the output measure. It is an average figure and indicates the cost needed per intervention. An economic cost analysis involves a broader evaluation of resources used, regardless of who actually pays for those resources. Calculation of unit economic costs includes financial costs, and values all resources that go into the program, at costs that reflect their true value in alternative uses.

To arrive at unit costs, it is necessary to first identify the components of the program, and then to cost each of these components in its entirety. Different approaches have been adopted for arriving at the functional components of an ART program, but we broadly distinguish the following components:

- ARV drugs
- OI treatment
- Diagnostic tests
- Outpatient department (OPD) service
- Inpatient department (IPD) service

Ideally, a full costing exercise should include both recurrent and capital costs, as well as fixed recurrent costs that are applicable every few years, like costs of training and maintenance. However, in this analysis, the capital costs have not been considered for three main reasons.

First, from the scaling-up perspective, the recurrent costs are more useful to policy makers, and equipment purchase—which in resource-poor settings often means a CD4 machine—can be treated as a separate item, whenever relevant. Second, the relevant capital costs for the ART center seemed to be a small component of total capital costs in the sample hospitals, so excluding these from calculations was unlikely to bias the unit costs estimates too much. Finally, and in view of the earlier points made, it did not seem worthwhile to pursue a tracking of capital costs in these hospitals, since the data on dates of purchase of machines and their lifespan were very difficult to obtain.

A key component of our costing exercise involves estimating shared costs, that is, costs of inputs that are not obviously part of the ART program, but indirectly are important for the program to run. In India, the program is being run in government hospitals, and a significant part of the ART program costs is being borne by the hospitals themselves, which is included in our analysis.

Regarding the costs incurred at the outpatient and inpatient departments, in addition to drugs and other costs, these would include human resources. Physicians' time (and that of other health care personnel) to look at patients, treat opportunistic infections (OI), or run the diagnostic tests are, in principle, already counted under these headings. However, if these individuals are spending additional time on the ART program, the value of additional time would need to be attributed to the program.

The analysis calculates mainly financial costs, rather than economic costs, using shadow prices. In the absence of capital costs, the relevance of shadow prices in the ART program comes mostly from the value of personnel in the program; however, since the perspective is programmatic, rather than societal (except for the component of costs incurred by an individual), only costs accruing to the government have been considered. It is recognized that physicians trained in the ART centers have high opportunity costs in the private sector, but if the government wants to scale up the program, it would have to hire the physicians at rates that are determined within the public sector pay scale, which does not allow for additional incentives.

Box 6.1

Studies of the Costs of National Antiretroviral Treatment Programs

At the macro level, cost studies can help track and assess the impact of funds and provide information for estimation of future resource requirements. There have been studies done on costing of ART programs with a view to informing policy on scaling up. The first country to offer a public program with ARV was Brazil, which triggered a spate of studies on cost and cost-effectiveness of ART (see, for example, Bastos et al. 2001). While pointing out the cost-effectiveness of ART, these studies also documented issues of program management and implementation. The more recent studies have taken as given the cost-effectiveness of giving ART, but have focused more on scaling up and their financial implications.

(continued)

Box 6.1 *(Continued)*

A review of several costing studies on South Africa (see Boulle et al. 2003) indicate that anticipated coverage remains the key uncertainty in cost estimates, and emphasize service capacity and readiness—rather than resources—as critical issues in scaling up. More recent costing studies look at resource requirements. For example, a study based on Nigeria (Kombe and others 2004) estimates the total cost of ARV in the public sector in Nigeria, and includes costs of voluntary counseling and testing, treatment of opportunistic infections, and other resource requirements of implementing the national program. They find that drugs comprise the largest single component (50 percent) of the total cost of the program, followed by monitoring tests and labor costs. Significantly, the study also finds that a large proportion of the treatment costs are borne by the patients for both tests and drugs. A similar study done for Zambia (Kombe et al. 2003) brings out the need for caution in scaling up based on estimates of per-unit cost of the government program, and from the perspective of sustainability.

A recent study from Thailand (Supakankunti 2004) evaluates the economic costs associated with the national program and analyzes the costs borne by patients and their productivity changes. In 2006, a national report for policy advice prepared by the World Bank (The Economics of Effective AIDS Treatment: Evaluating Policy Options for Thailand) evaluates the costs of various policy options by estimating the average costs of ART per patient by modes of service delivery, types of drug regimens, and stages of disease. The report concludes with the finding that under its primary set of assumptions, the Thai program to treat AIDS patients has the potential to save millions of lives, although the program is less cost-effective than a similar program with first-line therapy.

Extensive studies on ART costing in the context of South Asian countries are relatively rare, with the most recent one conducted in Gujarat using an incremental cost approach to calculate per-client cost of providing ART (Bhat and Saha 2006).

Cost analysis is a powerful tool, and programs can use the data generated to develop realistic budgets, calculate the efficient use of resources, and understand the demands of scale-up or replication (Guinness 2004). The interest in, and relevance of, costing also prompted a few attempts at coming up with a standardized costing tool; for example, the Cape Town Antiretroviral Costing model developed by Boulle et al. (2004) was aimed at researchers and planners for estimating the cost of ART programs using a series of simple worksheets.

Source: Authors.

Since the NACO program created an ART center at each site, and funded most of it, for estimating the **cost associated with the ART clinic,** this exercise entailed a straightforward collation of costs, mainly cost data from the SACS offices. Mostly, these were costs borne by NACO, but wherever any other staff was putting in full-time work, their time and salary were included as well. Attributing **costs at the level of the hospitals** is a more complicated exercise, involving the following steps:

- Identifying the major departments that were involved in treating ART patients. Most often the departments involved in the ART included medicine, skin/STD, and gynecology[4]
- Collecting total IPD and OPD data from these departments, as well as numbers of ART patients being sent to the various departments
- Collecting information on time allocation (for ART) of physicians and other health personnel of these core departments
- Identifying the major diagnostic departments involved in running tests for ART patients (microbiology, radiology, pathology, and biochemistry)
- Collecting details from each site on the various mandatory tests done for ART patients and frequency of such tests
- Eliciting from these diagnostic departments volume data on tests, so that allocations due to the ART program could be done
- Collecting departments' annual expenditure data for each of the core and diagnostic departments identified as being directly or indirectly involved in the ART program
- Allocating costs to each of the departments based on volume data
- Collecting volume data from voluntary counseling and testing clinics, which is taken to be the most unambiguous measure of increase in patient load, to see trends over time
- Collecting expenditures incurred by NACO/SACS on drugs purchased, training, and CD4 test kits and reagents.

Additionally, we collected data on the human resource costs incurred on the level of NACO and SACS that can be attributed to the ART clinic program by collecting data on the time allocation of the relevant staff.

Once all the cost components were in, the total cost for each of the sites was calculated and the unit costs arrived at by a simple division of total costs by the number of clients being treated at the end of the study period. An alternative definition of volume, defined by "total client months on therapy" at the end of study period, was also calculated and used as another denominator, as will be explained below.

An important component of the total cost of the ART program is expenditures incurred by the patients themselves in accessing ART from the sites. A total of 264 interviews were conducted, spread over all the ART sites, with a focused questionnaire that attempted to elicit the amounts individuals had to spend out of pocket to access the free ART at the sites, such as the costs of ART drugs, OI drugs, tests, transport, lodging, lost wages, and food. Some clients received support from various NGOs while they were on the government ART program; for lack of data availability, the costs of this support are not being considered in this analysis.

The study was completed in two phases. The first phase was an exploratory phase, where the initially selected sites were visited to understand the feasibility of the research. Based upon the analysis and findings of the first phase, the final list of sites was drawn up, methodology was finalized, and activities were mapped out for the next nine months of the project.

The following seven sites were selected for the study based on Phase I of the study, and in consultation with NACO:

- Government Hospital of Thoracic Medicine (GHTM), Tambaram, Chennai, Tamil Nadu
- Regional Institute of Medical Sciences (RIMS), Imphal, Manipur
- BJ Medical College, Ahmedabad, Gujarat
- Lok Nayak Jai Prakash (LNJP) Hospital, New Delhi
- Dr. Ram Manohar Lohia (RML) Hospital, New Delhi
- Government Medical College and Hospital, Trivandrum, Kerala
- Government Medical College and Hospital, Thrissur, Kerala.

Since the aim was to understand the cost of the Free ART Program, two sites that were initially not supported by NACO, but were also offering free treatment (supported by the state government) were included as well: these are the two Kerala sites at Trivandrum Medical College and Thrissur Medical College. The Trivandrum Medical College became a NACO-supported site in May 2005, and the Thrissur site was inducted into the NACO program in November 2005. This also allowed some analysis of the differences between a state-run program and a NACO-supported program. Over the two phases, several field trips, meetings, and discussions were held with a variety of individuals in the hospitals, SACS, and NACO, including the medical superintendents (MS) at hospitals, treating physicians, pharmacists, counselors, administrative officers, accounts officials, and others who were thought to be key informants for the research. The two main types of information—volume of patients seen and expenditure—primarily were collected from the medical records departments, the accounts section, and occasionally from the medical departments.

Overview of the Selected Sites

Most of the hospitals selected were multispecialty hospitals with medical colleges attached to them (table 6.2). Only GHTM, Tambaram, does not have a medical college, but is one of the oldest TB hospitals in India, which in recent years has also become one of the leading hospitals for

Table 6.2 Overview of the Selected Sites

Site city	*Year of establishment*	*Type of hospital*	*Specialty*	*Total OP 2005*	*Total IP 2005*
GHTM Chennai	1928	Super specialty	Well known for tuberculosis and HIV treatment; oldest NACO site	319,971	24,588
Medical College Trivandrum	1951	Medical college attached. Multi/super specialty	Kerala's oldest medical college; ART site started as state govt. initiative. Now converted into NACO site	453,691	65,754
Government Medical College Thrissur	1981	Medical college attached. Multi/super specialty	Kerala government started the ART site. Now a NACO site	118,913	21,616
BJ Medical College Ahmedabad	1953	Medical college attached. Multi/super specialty	Only ART site in Gujarat	638,017	66,670
RMLH Delhi	1930	Multi/super specialty	Funded by central government	1,157,653	48,937
LNJPH Delhi	1930	Medical college attached. Multi/super specialty	One of first NACO ART sites	1,062,768	67,960
RIMS Imphal	1972	Medical college attached. Multi/super specialty	Funded by central government through North East Council	237,297	27,588

Source: Authors.

treatment of HIV and AIDS. In terms of ownership, all the hospitals are under the respective state health departments, except the RIMS at Imphal, which is run by the Ministry of Development of North Eastern Region (DONER), and RML in Delhi, which is under the central health department. Most of these hospitals were established fairly early (two were pre-independence), and therefore have a long history of existence as well as repute. In terms of ordinary patient load, table 6.2 indicates that the volume of inpatient and outpatient load was significant in all the hospitals, with LNJP and BJ Medical College, Ahmedabad, topping the list for outpatients and inpatients, respectively. All the hospitals except GHTM, Tambaram, are capable of treatment of all opportunistic illnesses. GHTM, Tambaram—apart from treating TB cases—has a strong referral system with other local hospitals.

Table 6.3 gives details of when the ART program started in each site, and the study period. The duration of the reference periods across sites ranges from 12 months to 24 months. The reasons for this variation in the study period have to do mainly with data availability and the ease of access of up-to-date information in the limited time available for the study. While most of our analysis is based on these reference periods, we also discuss the differences in costs over a two-year period in one section, based on the data from those sites for which more than one year's data was available.

Recent trends in the number of clients seeking voluntary counseling and testing (VCT) in the selected sites (figure 6.1) suggest that the demand for such services increased over the observation period (early 2004 through

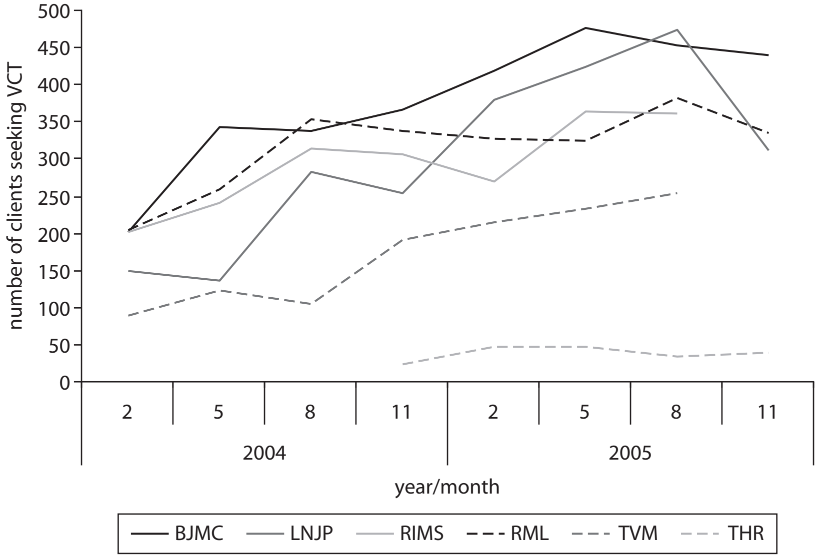
Table 6.3 Reference Period for Study

Site	*City*	*ART started*	*NACO site started*	*Study period*	*Study period in months*
GHTM	Chennai	1994	Apr. '04	April 2004–March 2006	24
TMC	Trivandrum	March 2004	May '05	April 2005–March 2006	12
BJMC	Ahmedabad	April 2005	Apr. '05	April 2005–March 2006	12
THR	Thrissur	November 2004	Dec. '05	Nov. 2005–Oct. 2005	12
LNJP	Delhi	April 2004	Apr. '04	April 2004–March 2006	24
RIMS	Imphal	1995	Apr '04	April 2004–July 2005	16
RML	Delhi	April 2004	Apr '04	April 2004–March 2006	24

Source: Authors.

Note: The ART program started in TMC November 2004, but became functional in the department of medicine only in March 2005.

Figure 6.1 Trend in Pretest Counseling at VCTC



Source: NACO-MIS.

late 2005). This could reflect an increase in HIV prevalence or the number of clients requiring treatment, or an increase in HIV awareness.

Before elaborating more on the actual functioning of the sites, brief mention must be made on the initial assistance given by NACO to start the program in the selected sites. At the time of setting up the sites, NACO had promised to sanction funds for two medical officers (one senior and one junior), one data entry operator (DEO), one counselor, one lab technician, and one recordkeeper/computer operator. In addition, a contingency grant of Rs. 100,000 was to be provided during the first year of the program, including the cost of a dedicated computer along with a printer and Internet. From the second year onward, a contingency grant of Rs. 50,000 was also to be given to each ART unit, according to the draft version of the National Guidelines for Implementation of Antiretroviral Therapy of August 2004.

We found that the study sites differed significantly from one another in terms of personnel, procurement of drugs for ART and OI, issues around treatment of opportunistic illnesses, and data management. Below, some of these issues and concerns are listed without mention of specific sites; it must be noted that not all the sites had similar problems.

- Initial funding for opening the site not always forthcoming.
- Dedicated physicians not in place (sites managed by drawing on the services of other doctors and postgraduate students).
- Counselors not appointed, and drawn from VCTC or telecounseling services.
- Smooth supply of drugs not always forthcoming.
- No clear guideline for drug dispensing at the sites; practices differed across sites.
- Pharmacist of the hospital overstretched and no allowance for designated ART pharmacist. Long waiting list for CD4 count investigation.
- Reagent supply for CD4 count investigation not always smooth.
- Lack of separate infrastructure for the ART site within hospital.
- Guidelines for initiating ART not always agreed to by physicians.
- Poor data management due to absence of DEO:/recordkeeper or lack of computerization.

Over the following year, many of these issues were ironed out, but some management concerns continue to plague the program. While costing the program in its entirety is important, the management and implementation issues are closely linked to costing: often some of the operational issues could be solved with careful planning around procurement, personnel, and infrastructure, all of which can be translated into funding implications. The financial feasibility question is therefore linked closely with the question on the extent of "structured"-ness of the government ART program. An earlier World Bank study (World Bank 2004) had described "structured" ART to mean treatment with the following features:

- Standardized, competency-based training of physicians in ART management
- Prescription of a standard triple-drug regimen
- Support from a multidisciplinary team that includes a counselor and a nutritionist
- Regular clinical and lab-based monitoring of the patient's treatment status
- Counseling to prevent transmission
- Prophylaxis for opportunistic illnesses when indicated
- Diagnosis and treatment of opportunistic illnesses.

Our study indicates that not all of these characteristics might be present in all of the sites. In particular, the first three points apparently were not always fully satisfied. None of the sites had a dedicated nutritionist who was helping the patients on ARV. As for prevention, counseling—while available—generally focused on the ART itself rather than prevention; the main task of the counselors was to explain the drugs and how often to take them. Other operational and management issues included the lack of a dedicated doctor specialized in ART, the lack of availability of specific drugs for prolonged periods, or the inability to recruit a data management person (which also hampered monitoring of the program to some extent).

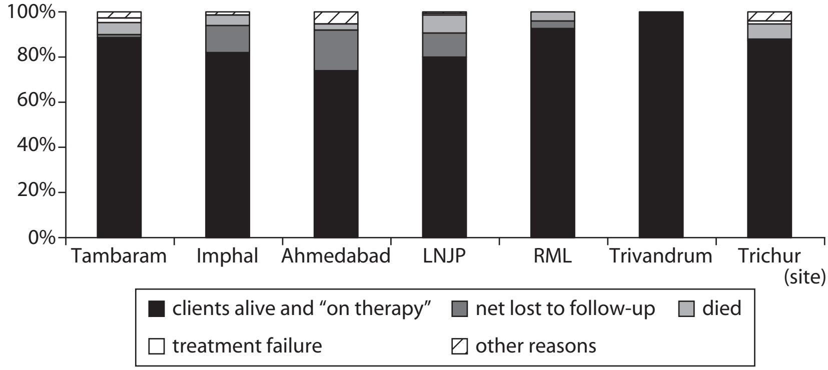
Another major finding of the team, not specific to the ART program, regards the general data management in the hospitals, especially bookkeeping and accounting. Only one of the hospitals had a breakdown of expenditures by department, which meant that the exercise on cost apportionment was almost impossible. Lack of proper data implies that many additional assumptions have to be made about how the total annual expenditure of the hospital should be divided among different departments, which renders the costing exercise somewhat tedious as well as imprecise.

Key Assumptions and Parameters

One of the most important, and conceptually most challenging, variables that went into the cost calculations is the number of patients receiving ART, that is, the choice of an appropriate denominator for our unit-cost calculations. The number of patients receiving treatment at any point in time is an imprecise measure, as it does not include patients who have died, experienced treatment failure, dropped out, or entered or re-entered a program later during the study period. (Also, in a setting where the number of people receiving treatment is increasing, the number of patients who have initiated treatment during the study period, or received treatment at the end of that time, may be far greater than the average number of people receiving treatment during that period.) Thus, matching the cost data (which would relate to costs incurred over a longer period) and the number of people on treatment is not a trivial exercise. Figure 6.2 illustrates this point—of patients who initiated treatment during the study period, between 10 percent and 20 percent had dropped out for various reasons in five of the seven sites by the end of the study period.

Table 6.4 presents alternative ways of looking at the number of people receiving ART. The first column presents the number of people who ever started treatment (initiated treatment during the study period), the next

Figure 6.2 Adherence and Reasons for Drop-out across Study Sites



Source: Authors' compilation of monthly ART reports from study sites.

Table 6.4 Volume on ART – Alternative Definitions

Site	*Number of clients ever started*	*Number of clients at the end of study period*	*Number of clients who have been on therapy for entire study period*	*Equivalent client months*	*Ratio of client months to clients ever started*
Tambaram	2,941	2,606	1,083	25,989	8.8
Imphal	276	226	228	3,642	13.2
Ahmedabad	1,635	1,210	819	9,824	6.0
LNJP	651	523	288	6,901	10.6
RML	1,302	1,205	555	13,317	10.2
Trivandrum	498	498	350	4,200	8.43
Thrissur	353	308	196	2,348	6.7

Source: Generated by authors.

one indicates the number at the end of the study period, and the third column indicates those who have been on therapy for the entire study period. The last column, which is the ratio of client months to those ever starting treatment gives an idea of the ability of the program to retain people. Given the staggered entry of clients into the program, and attrition due to various reasons, the number of people receiving treatment at any point in time is a very imprecise indicator of the scale of a treatment program. For this reason, our preferred measure of people receiving treatment is "the number of client months on treatment," which gives a much more accurate picture of the utilization of the various sites over the study period.[5]

Another important methodological concern is to what extent to attribute the volume of CD4 tests to the ART program. It is a matter of debate whether the entire CD4 testing in the reference period should be attributed to the ART program, because CD4 tests were routinely performed in many of the sites even before the ART program was put in place. One could therefore take the costs of only those CD4 tests applied to people receiving ART. However, this would give an underestimate of the cost of the ART programs because a CD4 test is essentially a screening device done prior to putting people on ART. The other option is to look at the trend in CD4 tests for those centers that had been doing CD4 testing prior to the start of ART, project the trend for the reference period, compare that with the actual CD4 tests done, and take the difference as the volume attributable to the ART program.

However, this approach was not easy to adopt. First, only three sites had CD4 testing facilities well before the start of the respective ART programs. Second, in one of these sites, RIMS, the numbers frequently bounced around, mainly due to self-rationing by the hospital, owing to the unavailability of drugs, as well as overuse of the machine. Tambaram had a profile very different from that of other general hospitals—TB and HIV were the two major diseases it was dealing with, and the CD4 numbers were understandably much higher than elsewhere. Finally, the CD4 numbers from RML, if projected (without ART), seemed similar to the ones with the ART program.

The issue of additionality of CD4 tests was, therefore, difficult to resolve. In our calculations, we have taken the current CD4 test numbers for calculating the additional test load, at the risk of slight overestimation of the respective costs. From the point of view of setting up a new site with a CD4 machine, there is no easy way to separate the spontaneous demand for CD4 from demand that is being generated in anticipation of the ARV treatment; thus, using the current numbers in the calculations may be a reasonable approximation. Regarding the workload for the microbiologist that can be attributed to the ART program, this seemed to be around 25 percent to 30 percent of working time on average.

Below, we discuss assumptions, findings, and data sources for the most important components of the costs of the ART program. Additional assumptions underlying cost estimates are provided in annex 6.1, and any site-specific assumptions are listed in annex 6.2.

- **Human resources to support the ART center.** Our research shows that many physicians at the hospitals are giving time to the ART centers, in addition to the ones hired specifically for the program. While the proportion of time spent on treating HIV patients by each practicing physician, and the number of physicians contributing to the program, varied from site to site—from one to about six physicians—(Tambaram)[6] in a general hospital, in no site was the ART center being run only by the ART doctor. In some sites, additional health care personnel like nurses were also involved. Most of the extra effort was coming from personnel from the medicine department, followed by the microbiology department.

- **Human resources at the ART center.** The NACO ART program envisaged that the following personnel would be required for running each site: two medical officers, one DEO, one counselor, one laboratory technician, and one recordkeeper/computer operator. Three out of seven sites did not have two medical officers when they were started, and counselors were sometimes initially taken from the VCT center. The rest of the personnel were appointed as scheduled in most of the sites; in a few sites the appointments were made late and essentially the hospital staffs were running the ART program for a long time. The costs of ART center personnel were straightforward to calculate and could be attributed entirely to NACO or the hospital.

- **ARV drugs.** The supply of ARV drugs presents a mixed scenario. While NACO was supposed to supply the drugs, the state-initiated programs were buying the drugs on their own through the SACS or relevant state departments. Even after these sites became NACO sites, the drugs continued to be supplied by the state government, at least for a while. Additionally, there were also instances of NACO-sponsored sites where local-level purchases were made by SACS to fill the demand gaps. The cost of these drugs was obtained from a variety of sources: ART monthly reports compiled at the sites (and submitted to the respective SACS) gave figures on consumption of the various drugs, which were then used in conjunction with unit prices (obtained from NACO, SACS, or other relevant state agencies[7]) to arrive at the total cost of drugs consumed. The weighted average of unit cost was calculated when there was more than one supplier, such as, both NACO and SACS.

- **CD4 kits and reagents.** Costs of CD4 tests were calculated based on prices of CD test kits and reagents, as explained in appendix table 6.1.

- **OI & prophylactic drugs.** The common prophylactic drug used was Septran; the costs of this and other common OI drugs were estimated using consumption figures.

- **Hospital department support to ART program.** Six departments, including four diagnostic departments—radiology, microbiology, pathology, and biochemistry—and medicine and skin departments were included in the cost calculations. Departmental costs were the most difficult to obtain, and could be obtained only for one hospital, RIMS, Imphal. Unfortunately, none of the general hospitals keep accounts separately for each department. Thus, the proportions on departmental breakdown of total recurrent costs from RIMS were used for the other hospitals to arrive at departmental costs for these six departments. For medicine and skin, total volume of inpatient admissions was taken as the denominator, and the admission of ART patients as a numerator. Capital costs, such as purchases of equipment, were left out of the calculations of the total costs.

- **Miscellaneous.** This involves refreshments, office charges like printing and stationery by SACS, and other petty expenses, obtained from the SACS office.

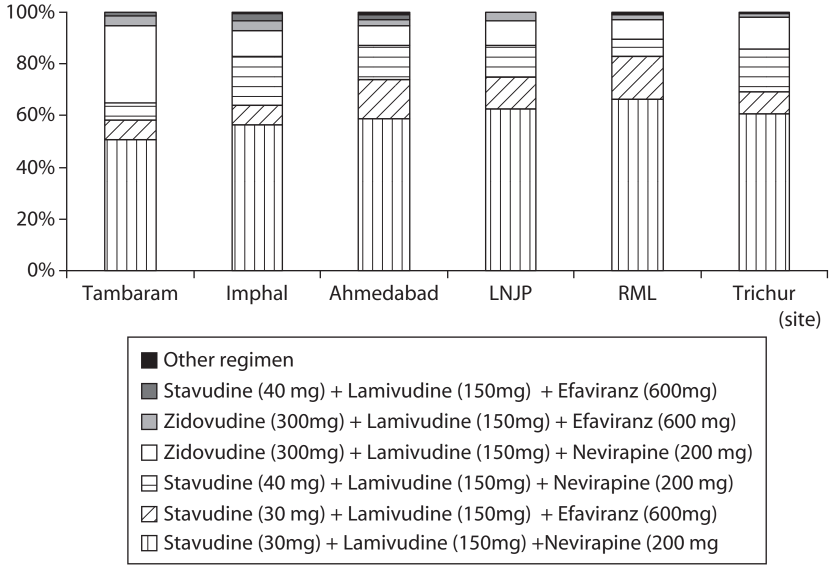
- **Contingency grant.** NACO grants Rs. 50,000 each year for operating expenses.

- **Training cost.** These include the training of an ART team consisting of 10 people[8] per site. NACO is responsible for arranging and funding all training in NACO sites. State programs like those in Kerala followed a slightly different pattern of training. Delhi SACS also arranged some training for counselors, which has been included under training costs. For RIMS and Tambaram, which are themselves training sites, there were no training expenses.

- **Establishment grant.** Additionally, NACO granted Rs. 50,000 in the first year, for example, for the purchase of a computer and printer. In one site, RIMS, there were expenses for building renovation, which were borne by the state SACS.

Before turning to the analysis, it is important to present the different drug regimens in some detail, since drugs and drug prices pay a central role

Figure 6.3 Distribution of ART Clients across Drug Regimens



Source: Monthly ART reports of study sites.

in the costing exercise. Figure 6.3 shows the various combinations used across the sites, reflecting that the government program is providing only the first-line drug regimen.[9] Apart from Tambaram, Chennai—where a significant proportion of clients are on Zidovudine combinations, and Imphal—where a number of clients are on Efaviranz due to the presence of Hepatitis B coinfection, most of the other sites are mainly using the combination of Stavudine (30 mg), Lamivudine (150 mg), and Nevirapine (200 mg). Clearly, the total cost of drugs across sites would depend on what combinations are being used, and in what proportions.

Costs of the ART Program

Table 6.5 presents per-client costs across the different items for all the sites based on client months on ART, and also provides costs obtained using the number of patients receiving ART at the end of the study period as the denominator. We first find that the monthly unit costs vary substantially across the sites. For "cost per client (a)," the unit costs range from about Rs. 970 per month to about Rs. 1,850. The last column of the table gives the average per-client cost, which comes to about Rs. 817, leaving out training

Table 6.5 Per-Client Cost across Sites and Items

								Average	
Sites	*Tambaram*	*Imphal*	*Ahmedabad*	*LNJP*	*RML*	*Trivandrum*	*Thrissur*	*(Rupees)*	*(Percent of total)*
Based on "client months on ART"									
Volume on ART	1,083	228	819	288	555	350	196		
Human resources (ART center)	153	253	71	337	147	85	95	163	12.7
Human resources (others)	84	163	63	137	81	90	68	98	7.6
ARV drugs	548	637	441	588	440	829	786	610	47.4
CD4 kits and reagents	225	478	309	179	220	422	0	262	20.4
OI drugs	11	136	11	8	7	9	12	28	2.2
Hospital department support	120	94	56	45	58	25	32	62	4.8
Miscellaneous	2	0	0	5	3	0	0	1	0.1
Contingency grant	2	8	0	0	4	0	0	2	0.2
Cost per client (a)	1,145	1,770	951	1,300	959	1,461	992	1,225	95.2
Training costs	0	0	10	30	16	24	215	42	3.3
Establishment grant	2	78	10	0	4	45	0	20	1.6
Cost per client (b)	1,147	1,847	971	1,330	979	1,530	1,208	1,287	100.0
Based on number of patients receiving ART by the end of the study period									
Volume on ART	2,606	226	1,210	522	1,205	498	308		
Human resources (ART center)	64	254	48	186	68	60	60	106	12.3

(continued)

Table 6.5 Per-Client Cost across Sites and Items *(continued)*

Sites	*Tambaram*	*Imphal*	*Ahmedabad*	*LNJP*	*RML*	*Trivandrum*	*Thrissur*	*Average (Rupees)*	*Average (Percent of total)*
Based on "client months on ART"									
Human resources (others)	35	164	42	76	37	63	43	66	7.7
ARV drugs	228	642	299	324	203	583	500	397	46.2
CD4 kits and reagents	93	482	209	99	101	297	0	183	21.3
OI drugs	5	137	7	4	3	6	7	24	2.8
Hospital department support	50	95	38	25	27	17	20	39	4.5
Miscellaneous	1	0	0	3	1	0	0	1	0.1
Contingency grant	1	8	0	0	2	0	0	2	0.2
Cost per client (a)	476	1,782	644	716	442	1,026	630	817	95.0
Training costs	0	0	7	17	7	17	137	30	3.5
Establishment grant	1	78	6	0	2	32	0	17	2.0
Cost per client (b)	477	1,861	657	733	451	1,075	767	860	100.0

Source: Authors' estimates.

and establishment grants; including these gives a per-client cost of Rs. 860. Table 6.5 also shows the share of each of the items in total costs, obtained from the last column on average unit costs.[10] Drugs comprise 47 percent of the total costs.[11] Costs of CD4 kits and reagents comprise about 25 percent, followed by human resources at the ART center. If we take all human resources, the proportion comes to about 21 percent.

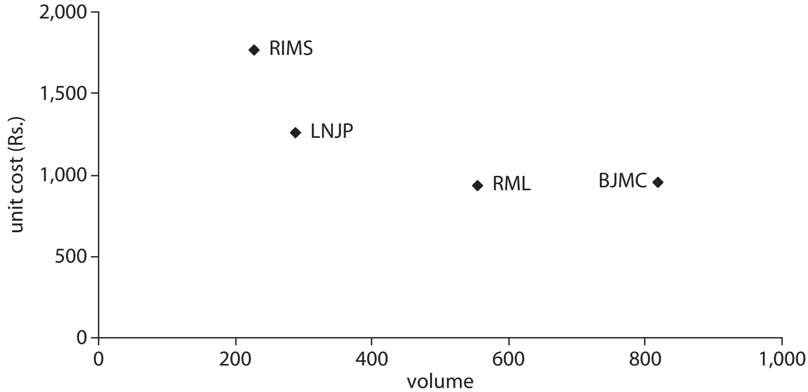
Table 6.5 also allows for a comparison of the structures of costs across sites. Consistently, the major cost driver remains the cost of drugs. Moreover, we note that whenever the sites could not take advantage of the bulk purchase done by NACO, the drug costs were high, as was the case with the Kerala sites and Manipur. Next in importance is cost of CD4 tests, which depend on both the volume (which makes it lower) and the number of mandated tests, which is hospital specific (Thrissur is an exception because it did not have a CD4 machine). As for human resources, the larger the hospital, the smaller is the burden on human resources; thus for instance, Ahmedabad, RML, and Trivandrum have a very low share of costs contributed by human resources.

Table 6.5 also provides the cost estimates obtained by using the number of clients receiving ART at the end of the study period as the denominator. This approach returns much lower cost estimates (and a higher variance across estimates), illustrating the pitfalls associated with using the number of clients at any point in time as a denominator (rather than indicators that measure the provision of ART across the study period), and being aware of the possibility of underestimating costs if only the total clients on therapy is taken as the denominator (which is easily available from the forms filled out by the sites and sent to NACO, and therefore may be used more frequently by researchers and other users).

A key issue for estimating or projecting the costs of an ART program is the extent to which unit costs change as the number of patients receiving treatment increases, in other words, the question whether there are economies of scale. Plotting the unit costs against the volume on ART across the NACO sites only (leaving out Thrissur, Trivandrum, and Tambaram because it is a specialized hospital), we find that there is some (negative) correlation between unit costs and the number of patients receiving treatment, suggesting the presence of economies of scale (figure 6.4).[12]

Unit costs may also change over time. This is an issue that we can explore to some extent because the study period extends over two years for some of the sites. Differences in unit costs over time may occur owing to start-up costs, or because the number of patients increases after the initial year. Table 6.6 presents the costs per client for

Figure 6.4 Unit Costs and Number of Patients



Source: Author's calculation.

Table 6.6 Annual Costs across Selected Sites, by Year (in Rs per year)

Sites	*LNJP Year 1*	*LNJP Year 2*	*RML Year 1*	*RML Year 2*
Client months	149	426	217	920
Human resources (ART)	556	261	315	103
Human resources (Others)	289	84	223	45
ARV drugs	607	521	490	373
CD kits and reagents	230	173	267	202
OI drugs	13	6	10	4
Hospital department support	81	58	105	48
Miscellaneous	19	0	13	3
Contingency grant	0	0	0	5
Total recurrent costs	1,795	1,103	1,423	783

Source: Authors' estimates.

RML and LNJP for each of the two years for which data were available from these hospitals.[13]

For both hospitals, the number of patients receiving treatment increased markedly, while unit costs were much lower in the second year. This was due to two reasons. First, the prices of ARV drugs were significantly lower in the second year, which may reflect the fact that prices of ARV drugs have been falling over the study period, rather than scale effects in procurement. Second, the key factor behind the decline in unit costs is the fact that human resource costs increased at a much slower rate than the number of patients receiving treatment (accounting for 72 percent (at LNJP) and 61 percent (at RML) of the decline in unit costs). This is an important finding for the purpose of a scaling-up exercise, as the second-year estimates would be more representative for this purpose.

While the analysis was underway, the prices of ARV drugs had already come down substantially, and NACO was able to procure these drugs at a much reduced rate. It is easy to see that further reductions in the prices of ARV drugs and CD4 tests kits could significantly reduce the unit costs of the program. Table 6.7 illustrates this point—a reduction in the prices of ARV drugs and CD4 test kits of 50 percent would bring down the costs per client of the program by about 23 percent. The effects of such reductions on future cost projections will be discussed later in the chapter.

From the perspective of scaling up, and in addition to the overall costs of the ART program, it is important to know to which entities these costs are allocated. Table 6.8 shows the distribution of total costs across various agencies (SACS, NACO, the hospital, and the state government). While the expenditure incurred by the hospitals is also ultimately borne by the state government (Department of Health), functionally these are different entities, and the costs incurred are therefore presented separately. In fact, the funds of the various SACS come from NACO as well, but since the ART program is a separate subprogram of NACO, the analysis separates expenditures of SACS from NACO.

Table 6.8 presents the allocation of total recurrent costs (excluding the fixed costs of training and establishment,[14] showing that slightly less than half of the total cost of running the program is borne by NACO; the

Table 6.7 Estimated Unit Costs with Reduced Prices of ARV Drugs and CD4 Test Kits

Site	*No change in prices*	*Prices of ARV drugs down by 50%*	*Prices of ARV drugs and CD4 kits down by 50%*
Tambaram	1,145	871	759
Imphal	1,770	1,451	1,212
Ahmedabad	951	731	576
LNJP	1,300	1,006	916
RML	959	739	629
Trivandrum	1,461	1,046	835
Thrissur	992	599	599
All sites	1,225	920	789
Average	1,264	974	821

Source: Authors' estimates.
Note: The average excludes Thrissur, since it did not have costs of CD4 tests.

Table 6.8 Distribution of Costs across Sites
(Percent)

Sites	*SACS*	*NACO*	*Hospital*	*Other*
(Actual distribution of costs)				
Tambaram	22	51	22	6
Imphal	38	49	13	
Ahmedabad	47	41	12	
LNJP	24	48	28	
RML	31	49	20	
Average across selected NACO sites*	35	47	18	
(Distribution of costs if CD4 kits and ARV drugs purchased through NACO)				
Tambaram	2	71	22	6
Imphal	9	78	13	
Ahmedabad	2	87	12	
LNJP	3	70	28	
RML	2	78	20	
Average across selected NACO sites*	4	78	18	

Source: Authors.
* Imphal, Ahmedabad, RML, and LNJP.

SACS are also spending a significant amount of funds from other sources to run the ART program, mostly on the CD4 kits and reagents. Finally, the hospitals themselves bear some of the burden (mainly through departmental support and personnel), though they do not receive any additional funding for running the program. A new development is the proposal of NACO to centralize the purchase of CD4 kits and ARV drugs. Centralized procurement of CD4 and ARV drugs by NACO would not only shift the burden of costs away from hospitals (NACO would bear about 78 percent of the total program cost), it might also lead to lower aggregate costs, if distributional costs are not too high.

Out-of-pocket Expenditure

From a macroeconomic or general welfare perspective, an important aspect of the costs of the ART program is the amount of out-of-pocket spending by individuals when they access ART. To analyze this, we obtained a sample of 264 individuals from the seven sites by interviewing patients coming back for their monthly refill of ARV drugs.[15] Out of the sample of 264 individuals, 68 percent were males, and the average age of respondents was 36. About 74 percent of the respondents were currently married, and 18 percent were single. The rest comprised widows, divorcees, and so forth. More than half of the individuals in the sample were currently working.

It is important to note that about 26 percent of the respondents were non-naïve, or had accessed ARV before joining the free program. The most common reason cited for discontinuing treatment was financial difficulties, which indicates that the free program is a welcome step for many. At the same time, the fairly high percentage of non-naïve patients has implications for both subsequent adherence as well as spread of resistance strains, and is an important factor to be kept in mind when scaling up.

On average, respondents had participated in the Free ART program for at least 12 months. The questionnaire asked in detail about different type of expenditures incurred while accessing ART. Table 6.9 indicates the percentage of individuals who spent non-zero amounts on any of the items, and the average monthly expenditure on these items. On average, individuals were spending Rs. 911 per month to access the free ART. Food and nutrition expenses (23 percent) comprised the largest share of access costs,[16] followed by transport (17 percent), and tests (13 percent for initial testing and monitoring). While this amount does not seem a large sum, a regular monthly expenditure of about Rs. 1,000 would mean a significant burden of treatment for poorer socioeconomic categories. The average out-of pocket spending is almost equal to unit cost of provision of therapy, suggesting that the actual cost of accessing ART is double that of the cost of provision. Interestingly, the distribution

Table 6.9 Out-of-pocket Expenditure to Access ART

Item	*Non-zero responses (Percent)*	*Average expenditure (Rupees per month)*	*Average expenditure (Percent of total)*
ARV	12	27	3.0
OI drugs	52	108	11.9
Vitamins	41	54	5.9
Food and nutrition	56	212	23.3
Initial test	61	96	10.5
Monitoring test	21	18	2.0
Hospital stay	35	88	9.7
Transport	96	158	17.3
Wage loss	39	83	9.1
Lodging	4	18	2.0
Other	63	50	5.5
Total expenditure		911	100.0

Source: Authors' survey.

across sites of total out-of-pocket expenditure seems bimodal, with four sites showing expenditures above Rs. 1,000 per month, and the remaining showing expenditures between Rs. 650 and Rs. 850.

The importance of nutrition in ART is now slowly gaining recognition,[17] and there is some evidence to suggest that the efficacy of treatment in a well-nourished person is better than in an undernourished one. Presumably, the doctors prescribing the medicines, as well as the counselors, are advising the patients about the kinds of food they should be eating. While most of the patients who access ART in these clinics are from less well-to-do backgrounds, the messages are clearly getting across, since a large percentage of them are found to be taking additional nutrition while on ART. As for transport cost, the importance of this in the context of health-seeking behavior is now well documented. Thus, it is not surprising that transport constitutes a significant part of the total out-of-pocket expense. Also, our findings are comparable to other studies, which have found that tests can impose a significant burden on individuals and they are less willing to pay for tests than for drugs (Gupta and others 2004). Finally, if economic burden is a reason for nonadherence for some clients, our results suggest that there is some justification in trying to find alternative sources of financing for some of the major items, like food, tests, and transport; this may ensure higher adherence and a better treatment outcome.

Projected Costs of India's Free ART Program

One of the potential uses of our unit cost estimates is to inform an analysis of the financial implications of a potential scaling up of India's Free ART program. Table 6.10 gives an example of a financial planning exercise, based on NACO's aim to put 100,000 people on ART by the end of the 2007 financial year, and thereafter an additional 15 percent to 20 percent for the next five years (NACO ART Guideline 2004). While such projections do not address the issue of deaths directly, they do so indirectly, by using the total number of people receiving treatment as the basis for calculations, which is net of attrition due to death, nonadherence, and treatment failure. It is important to point out that the calculations are based on recurrent costs, and do not include the costs of new CD4 machines or other fixed costs, which would have to be calculated separately.

The unit cost underlying the estimates reported in table 6.10 is based on the one reported in table 6.8. Also, we assume that NACO is going to bear the costs of CD4 test kits and ARV drugs. Thus, starting with a

Table 6.10 Projections of Costs of ART Programs

Year	*Projected number of patients*	*Annual cost*		*Costs (in rupee millions) incurred at*		
		Rupee millions	*US$ millions*	*SACS*	*NACO*	*Hospital*
At current unit cost of Rs. 1,264						
2007	100,000	1,517.3	35.3	37.8	1,226.3	253.3
2008	110,000	1,669.1	38.8	41.6	1,348.9	278.6
2009	121,000	1,836.0	42.7	45.7	1,483.8	306.5
2010	133,100	2,019.6	47.0	50.3	1,632.2	337.1
2011	146,410	2,221.5	51.7	55.3	1,795.4	370.8
Total		9,263.5	215.4	230.8	7,486.4	1,546.3
(percent of total)		100		2.5	80.8	16.7
At reduced unit cost of Rs. 974 (owing to lower prices of antiretroviral drugs)						
2007	100,000	1,168.9	27.2	37.7	877.9	253.3
2008	110,000	1,285.8	29.9	41.5	965.7	278.7
2009	121,000	1,414.4	32.9	45.6	1,062.2	306.6
2010	133,100	1,555.8	36.2	50.2	1,168.4	337.2
2011	146,410	1,711.4	39.8	55.2	1,285.3	370.9
Total		7,136.5	166.0	230.3	5,359.5	1,546.7
(percent of total)		100		3.2	75.1	21.7
At reduced unit cost of Rs. 821 (owing to lower prices of antiretroviral drugs and CD4 tests)						
2007	100,000	985.6	22.9	37.7	694.5	253.3
2008	110,000	1,084.1	25.2	41.5	764.0	278.7
2009	121,000	1,192.5	27.7	45.6	840.3	306.6
2010	133,100	1,311.8	30.5	50.2	924.4	337.2
2011	146,410	1,443.0	33.6	55.2	1,016.8	370.9
Total		6,017.0	139.9	230.3	4,240.0	1,546.7
(percent of total)		100		3.8	70.5	25.7

Source: Authors' estimates and projections.

unit cost of Rs. 1,264 per month (which translates into about US$350 per year), we find that the total cost of the program over the next five years would be US$215 million, out of which NACO's share would be 81 percent. One important determinant of the future cost of providing ART are developments in the prices of ARV drugs. Table 6.10 therefore also reports cost projections for alternative scenarios—one in which the prices of ARV drugs are reduced by 50 percent from 2007 onward, and one in which the price of CD4 test kits is also reduced by 50 percent. Under these scenarios, the total cost of the program over the five years under consideration would be reduced from US$215 million to US$166 million. As the costs of ARV drugs and CD4 test kits are assumed to accrue to NACO in our projections, its share in the overall costs declines as the respective prices decline, from 81 percent without price changes, to 71 percent in the scenario with falling prices of both ARV drugs and CD4 kits.

One interesting point to note is that whichever entity bears a larger share of the fixed costs of the program (in this case personnel costs borne by hospitals) will increasingly bear a larger share of the total costs, with decreasing prices of the "consumables" (ARV drugs and CD4 kits). This also explains why, over the three scenarios (baseline, reduced costs of drugs, and reduced costs of drugs and kits), SACS show a slight decline in the total costs, whereas the hospitals experience a slight increase.

Discussion of Findings

Some key results are summarized in box 6.2. However, before discussing the implications of our findings, some limitations of the research need to be mentioned. The first regards sample size. Owing to budget and time constraints, only seven samples were included in the study. The samples differed based on parameters like initiation date of the ART program, who started it (NACO/state), the type of hospital, the number of people receiving ART, and location (high-prevalence states vs. other states). This has led to some loss of generality in the results. However, we found that the general hospitals had more or less similar structures of operation, and unit costs appeared to converge in the second year of operation; the fact that our findings were quite similar across hospitals thus suggests that the sample size limitation may not have hampered the analysis too much.

The second main limitation regards the availability of cost and other data from hospitals. Only one hospital was able to provide cost data disaggregated by department, which was an important constraint for this research. Moreover, data regarding the number of patients receiving ART and the provision of drugs and tests were not computerized in some hospitals, and collection of data from hard copies was both tedious and fraught with potential copying mistakes. The data limitations extended the process of data collection and revisions by a few months, and squeezed the analysis time. Many innovative ways of cross-checking the data collected had to be undertaken and the team had to "revisit" (literally and through many phone calls) the sites many times to get more accurate information.

Box 6.2

Summary of Key Findings

(1) The average per-month, per-client recurrent cost of the ART program is Rs. 1,264, or about US$30; thus, the annual per-client cost is Rs. 15,168, or US$353.
(2) Our data point at the presence of economies of scale in provision of ART—the total costs are proportionately lower for NACO centers with a higher number of clients (across center and as centers expand over the study period).
(3) The bulk of the costs come from drugs (46%), followed by CD4 test costs (24%) and human resources (22%).
(4) On average, NACO bears 47% of the costs of providing ART in the participating sites, with SACS accounting for 35% and hospitals for 18%.
(5) A reduction in the prices of ARV drugs and CD4 test kits by half would reduce the per-client cost of treatment by 23%.
(6) Centralizing drugs and CD4 test kit purchases will shift the burden (of a lower total cost amount) mostly to NACO, and its cost share will increase to 78%.
(7) The expenditure incurred by the clients themselves while accessing ART is about Rs. 900 (US$21) per month.
(8) Thus, the societal cost of ART comes to around between Rs. 2,164 per month or Rs. 25,968 annually (US$604).

Source: Author.

We estimate the annual unit cost of ART provision at about US$353 without taking into account the costs borne by the individuals. This works out to be US$1 a day; if one adds about US$0.7 per day based on the individual costs, the cost per day comes to around US$1.70. An earlier World Bank study (Over and others 2004) estimated the cost per year for structured ART in India at US$600 (not including the individual costs). The difference is mainly due to a difference of about six years between the two reference periods, during which time the cost of ARVs have fallen substantially. Including individual costs in a similar study in Thailand (Supakankunti 2004), suggests a monthly cost per client US$78 per month, or US$2.50 per day, which is somewhat higher than the figure estimated in this study. Thus, in an absolute sense, the cost of provision in India does not appear to be very high; however, given the increasing number of individuals who will need to be put on therapy and kept on it, it translates into substantial financial commitment for the government.

A crucial variable for estimating annual costs will of course be the number of people initiating and receiving ART. The evidence indicates that there is a continuous demand for ART; there are sites that are unable to put everyone on it, and have created waiting lists. A related issue is the relation between demand and quality—the quality of the government program determines to what extent individuals would want to join it, and how many of them would prefer private providers, despite the cost difference. Again, the evidence gathered from the sites and from the experts consulted seems to indicate that the quality of the program has been quite good, with significantly high levels of adherence at all the sites. This has ensured a moderately high level of demand for the government program. Thus, if the quality is maintained at this level in years to come, there may be a switch away from the private to the public sector, which will only help keep up the demand.

How do our estimates of costs compare with the health budget of the country? The question of affordability was also raised by the World Bank study referred to earlier, which indicated that the cost of the most ambitious of the ART programs (to support all those below the poverty line) would be about 70 percent of central health expenditure (Over and others 2004). However, since then, prices of ARV drugs have come down significantly. Also, there have been substantial increases in the allocation to the Ministry of Health and Family Welfare, and restructuring of the programs, so that it is no longer meaningful to talk only about health expenditure. The revised health and family welfare budget for 2005–06 amounted to about US$2,250 million. Our estimates of cost of the ART program for 2007 (without any changes in costs of ARV and test kits), comes to about US$35 million, which is around 1.5 percent of the total health and family welfare budget. A 50 percent reduction in both the prices of drugs and kits reduces the amount to about 1 percent of the health and family welfare budget. The comparison with the earlier World Bank study and the different cost estimates within this study indicate that there are substantial savings to the program costs through reductions in prices of drugs and kits. As for NACO's own resources (excluding GFATM funds), the budget estimate for 2006–07 is US$148 million (MOHFW 2006); using the lower estimates of the ART program, the total ART cost for 2007 would be US$23 million, which is about 16 percent of NACO's core resources. If we assume that only 70 percent of the total cost would be covered by NACO, about 11 percent of total core resources of NACO would be required for the ART program for 2007.

The exercise above provided an illustration of the possible implications of a scaled-up program. Clearly, the question of financial sustainability is critical, and Financial Sustainability Planning, an exercise advocated and practiced in the case of immunization by the Global Alliance for Vaccines and Immunization (GAVI) could be usefully applied in the present context, too. While most of the cost would have to be borne by NACO, the sites may need additional help and funds so that their current services for other departments are not hampered. Additionally, if adherence of the program is seen as the most critical component of the public program, then individuals may need additional assistance, especially in light of the role of nutritional supplements to ensure that the ART works optimally.

Currently, NACO's ART program is being supported by GFATM. However, the sustainability of this funding and the possibility of other donors to support a scaled-up program are issues that NACO will need to focus on immediately. Additionally, if NACO plans on adding second-line drugs to the program, this would have significant financial implications for the program.

Careful planning, identifying ways to bring down costs without sacrificing quality, and negotiations with donors are strategies that need to be worked on simultaneously in the immediate future to ensure that the ART program remains sustainable.

Outlook

There are numerous ways this work can be utilized and extended. The first step involves active dissemination of the results to show the potential of such costing studies to NACO and the state governments that are running state-level ART programs, and also to give them some preliminary estimates of costs that they may find useful in their planning activities. It is also important to demonstrate the usefulness of such cost estimates in a financial sustainability planning exercise that not only charts out costs over the years, but also records the sources of secure and probable funding. This will allow NACO to negotiate with future donors on the basis of more solid data The results of this study may also be useful to other parts of the government, like the Ministry of Health and Family Welfare and the Planning Commission, to enable them to mainstream HIV and AIDS treatment programs into national planning activities.

This study also establishes a baseline of unit costs and can be used for cost-effectiveness analysis, for example, of a second-line ART program. It can also be used to understand the implications of (and interactions between) treatment success and adherence, which are bound to have cost implications. For example, our data from six sites show a positive, though weak, correlation between duration of exposure to treatment and total dropouts. Such a correlation can be expected for any disease; however, there are many causes of dropouts in the case of ART, and comprehensive research can be carried out to understand all the determinants of dropouts and treatment success in conjunction with a costing study, to evaluate the effectiveness of the program.

Finally, the results of this study could also be useful to the many other stakeholders involved in the study, in particular the hospitals and SACS. This will enable them to plan resource allocation and negotiate with NACO/state governments with better information. It may hopefully also serve as an advocacy tool for greater efficiency and transparency in data management, so that they can continue to be important partners in research endeavors that have important implications about their own work, as well as national policies.

Annex 6.1 Additional Assumptions Underlying Cost Estimates

Clients on ART	Available from monthly reports ART centers prepare and send to respective SACS
Human resources (NACO)	Estimated proportion of time spent by the NACO staff on the ART program was arrived at based on discussions. Actual proportion of time. See annex 6.2.
Human resources (SACS)	Estimated proportion of time spent by the SACS staff on the ART program was arrived at based on discussions. Actual proportion of time. See annex 6.2.
Human resources (ART Clinic)	NACO ART guideline specifies the details of staff to be appointed at the ART clinic. It was verified at respective sites, and actual "in-place" staff were taken into account. Additionally, details of dedicated ART clinic staff—other than NACO sponsored—were taken into account.
Human resources (Hospital staff)	In addition to the ART clinic staff, hospital physicians, especially from the medicine and microbiology departments, were actively involved in the ART program. The medicine department physicians' time was apportioned to the ART program based on discussions around their perceptions about involvement in the program at respective sites. For the microbiology department, 25% of the time of one faculty was accounted for based on various discussion at all the sites.

Annex 6.1 Additional Assumptions Underlying Cost Estimates *(continued)*

ARV drug consumption	Available from monthly reports that ART centers prepare and send to respective SACS.
ARV crug expenditure	ARV drugs supply and consumption figures are available from monthly reports. The unit prices of different drug molecules for the years 2004-05 and 2005-06 were obtained from NACO. Since the drug prices during two years and volumes of drug supplied to different sites were different, a site-specific weighted average unit cost was calculated. Finally, the total consumption figures were multiplied with the weighted average unit prices to get the total expenditure on ARV. In the case of state-level purchasing of ARVs, a ratio of NACO and state supply was calculated, and accordingly, the expenditure—based on two different unit costs—was calculated.
CD4 kits/reagents expenditure	Unit cost of CD4 test kit was collected from respective SACS. The unit cost of sheath fluid was calculated based on Delhi SACS data and applied to all other sites. Total expenditure was calculated based on unit cost and total consumption.
CD4 test volume	Monthly data on CD4 testing, control, and failed tests were available from microbiology labs. The sum of these yielded total consumption of CD4 tests. A container of 20 liters of sheath fluid was assumed to be required for 150 CD4 tests.
Prophylaxis: Septran (Cotrimoxazole) consumption	All centers provide Co-trimoxazole—one tablet a day—to all clients having a CD4 count less than 200 cells till it improved beyond 200 cells. Only Imphal could provide actual consumption data for the study period. The CD4 count profile of ART clients was only available from Ahmedabad and thus, this proportion (73% of clients would take Septran for six months and 11% for a year) was applied to sites where actual/estimated proportion was not available.
OI drug consumption	Only RIMS and Trichur could give data on actual consumption of OI drugs. For other centers, consumption of OI drugs had to be calculated based on the profile of OI infections among clients and prescribed dosage, which was available only for Ahmedabad; the proportion of clients with major OIs was calculated for Ahmedabad and used for other sites.
OI drug expenditure	The unit price of OI drugs was available for Manipur, Trivandrum, Trichur, and Tambaram. The figures obtained from the rate list of the Directorate of Medical Education, Kerala, for the unit price of OI drugs were used for those sites where relevant data was unavailable. Total expenditure was calculated based on unit cost and total consumption.
Hospital volume patients	Departmental OP and IP figures available from Medical Records Department (MRD) for calendar year 2004 and 2005.
Hospital volume laboratories	Laboratory volume figures (of tests) were available from MRD for calendar year 2004 and 2005.

(continued)

Annex 6.1 Additional Assumptions Underlying Cost Estimates *(continued)*

ART clients volume laboratories	All clients who were on therapy had to undergo a list of tests at different laboratories. The volume of these tests was available from monthly reports. Additionally, it was assumed that the same number of clients would go in for repeat testing at stipulated time intervals. This volume was calculated based on "net clients on therapy," i.e., total clients on therapy minus estimated dropouts. List of compulsory tests is given in annex 6.3 .
Hospital department support	Mainly two clinical departments (medicine and dermatology) and four diagnostic departments (pathology, biochemistry, radiology, and microbiology) were actively involved in the ART program. Only Manipur could provide departmental expenditure details. No sites could provide rate lists of various procedures being done at these laboratories. Thus, the proportion from Manipur was used to calculate departmental costs from total hospital costs, and the rate list of Manipur was used to calculate the ART lab coefficient. However, the list of compulsory tests was site specific. The cost apportionment for these departments was done as discussed below.

Proportion of A dept. cost (%)	Pa	From Manipur data
ART proportion coefficient_IP(%)	Xai	ART inpatients/Total inpatients
ART lab coefficient (%)	Xlab	Rate of ART tests/Rate of total tests
ART proportion coefficient_lab (%)	Xal	# of ART pts tests/total pt tests
Cost of A department (Ca) =		[Total hospital costs * Pa]
ART cost of A department_inpatient =		[Ca * Xai]
ART cost of A department_lab =		[Ca * Xlab * Xal]

The methodology is different for Tambaram, which is given in detail in the annex on specific-site assumptions.

Source: Authors.

Annex 6.2 Site-specific Details and Assumptions

Government Hospital of Thoracic Medicine (GHTM), Tambaram, Chennai, Tamil Nadu	
Prophylaxis—Septran (Co-trimoxazole) consumption	CD4 count profile of ART clients could not be made available. However, discussion with Tamil Nadu SACS (TNSACS) staff indicated a proportion of 85% for six months and 15% for a year.
OI drug consumption	GHTM dispenses many OI drugs; however, actual consumption of OI drugs or profile of OI infection was not available. The proportion of clients that may have major OI was calculated based on various discussions. The estimated consumption was calculated based on dosage and estimated clients that may have different OI infections.

Annex 6.2 Site-specific Details and Assumptions *(continued)*

Hospital volume patients	The departmental patient load was available for the years 2004, 2005, and up to March 2006. The volume was apportioned for the study period from April 2004 to March 2006 accordingly.
Hospital volume laboratories	The monthly patient load for various tests and procedures for all the labs was available for the study period. The number of haemograms was taken as a proxy for the pathology lab and liver function tests as a proxy for the biochemistry lab.
ART clients volume laboratories—details of repeat test frequency	Following tests are being repeated at every three months: haemogram, liver function, urinary creatinin, blood sugar, x-ray.
CD4 test volume	CD4 test volume data available monthly from the labs at Tambaram hospital.
Human resources (SACS)	The project director, deputy director, ART consultant, and finance controller at TNSACS contributed to the ART program. The salaries of the deputy director and ART consultant were provided by WHO.
Human resources (ART)	In addition to the NACO-sanctioned staff at the ART clinic, seven medical officers are working at the ART clinic—three of whom are sponsored by WHO, two by SACS, and one each by the Clinton Foundation and the hospital itself. The hospital also sponsors two dedicated nurses and a pharmacist for the ART clinic. One additional counselor is sponsored by the Thai foundation.
Human resources (hospital staff)	Ten hospital physicians contribute to the ART program. The exact proportion of their time dedicated to the ART program was collected from the Medical Superintendent (MS) of the hospital. Additionally, 5% of a pathologist's time was allocated to the ART program.
ARV drug expenditure	TNSACS has supplied Efaviranz 200 mg and also 11% of total Efaviranz 600 mg consumed during the study period.
CD4 kits/reagents expenditure	The cost of a CD4 kit was different for the two years.
OI drug expenditure	Estimated consumption of major OI drugs was multiplied with unit prices at which Tambaram hospital purchased them to get the total OI expenditure. All expense on OI drugs is borne by the hospital itself and no grant in this regard is available from SACS.
Hospital expenditure	Expenditure data for financial year 2005/06 was available only up to February; it was extrapolated for the financial year 2005–06.
Hospital department support	Tambaram hospital is mainly an HIV and TB center with no demarcated clinical departments unlike a medical college-affiliated general hospital. The total bed count is 896, and there are 31 wards, with eight especially for HIV patients, including ART. The diagnostics include a central laboratory, which performs all pathology-, biochemistry-, and microbiology-related tests, and a radiology section, which performs imaging diagnosis; being a TB center, radiology is an important cost center. Thus, the proportion from RIMS is inappropriate here. A separate system was worked out.

(continued)

Annex 6.2 Site-specific Details and Assumptions *(continued)*

	The estimated costs of rehabilitation center—which is an exclusive setup with 120 beds—were calculated based on bed proportion, and deducted from the total expenditure. Since department-level expenditure was not available, unit costs of different diagnostic units was worked out based on RML hospital's volume and expenditure estimates. The remaining expenditure was divided across IP and OP in equal proportion given than OP setup is a significant one. The IP expenditure, which was assumed to have relevance to the ART program, was then divided across HIV and non-HIV ward expenditure based on the number of wards. ART patient coefficient, ART lab coefficient, and departmental support expenditure were calculated like other sites, as discussed the methodology section.
Regional Institute of Medical Sciences (RIMS), Imphal, Manipur RIMS, Imphal	
Hospital volume patients	The patient load for July to August for the years 2003–04 and 2004–05 was used to apportion the total hospital volume for the study period.
Hospital volume laboratories	Volume of various tests was available from annual reports. Volume of haemogram was taken as a proxy of volume of the pathology lab; liver function for biochemistry and HbAsg test was taken as a proxy for the microbiology lab. Total x-ray volume was used as a volume of the radiology department. July to August figures for the years 2003–04 and 2004–05 was used to apportion the total hospital volume for the study period.
ART clients volume laboratories	There are no mandatory repeat tests, but according to the treating physician, nearly 50% of patients need to undergo repeat test as mentioned below: haemogram, liver function test.
Human resources (SACS)	Delhi SACS estimates of proportion of time in the program were applied. However, actual salary was available from the Manipur SACS.
Human resources (hospital staff)	One professor, one associate professor, and three assistant professors give on an average 6% of their time to the ART clinic. A store officer looks after entire logistics around ARV and OI medicines and gives 30% of his time to ART program.
ARV drug expenditure.	MSACS supplied around 51% of the total Efavirenz 600 mg.
Hospital expenditure	Expenditure data for financial year 2004/05 and 2005/06 was available. Appropriate apportionment was done for April 2004 to July 2005.
BJ Medical College (BJMC), Ahmedabad, Gujarat	
Hospital volume patients	The patient load for December 2004 to November 2005 was used as a proxy of financial year 2005–06.
Hospital volume laboratories	Actual load of different laboratories was available from MRD. The patient load for December 2004 to November 2005 was used as a proxy of financial year 2005–06.
ART clients volume laboratories	Following tests are repeated every six months: haemogram, liver function. X-ray is repeated every nine months.

Annex 6.2 Site-specific Details and Assumptions *(continued)*

Human resources (NACO)	An average time apportioned to Ahmedabad was calculated based on the number of sites operating at the end of the year, i.e., 54 sites for 2005–06.
Human resources (SACS)	Actual proportion of time of SACS staff was estimated based on discussions with the additional project director.
Human resources (hospital staff)	All ART clients need to first visit department of medicine, and only those who have been screened are referred to the clinic. Thus, the involvement of the medicine department is significant. Six professors, three associate professors, and one assistant professor from the department of medicine contributed 9%, 7%, and 4% of their time, respectively, to the ART clinic.
ARV drug expenditure	Gujarat SACS has supplied a significant proportion of all the medicines—except Zidovudine combinations—account for almost 28% of the cost of total ARV consumption.
OI drug expenditure	As the unit cost of OI drugs was not available, the costs from Tambaram hospital were used to arrive at estimated total expenditure on OI drugs.
Hospital expenditure	College expenditure was available for the financial year 2005–06 and hospital expenditure was available only till December 2005; this was extrapolated for the financial year.
Lok Nayak Jai Prakash (LNJP) Hospital, New Delhi	
Prophylaxis—Septran (Co-trimoxazole) onsumption	CD4 count profile of ART clients was not available. Septran consumption was calculated based on the CD4 count profile of clients of Ahmedabad site.
OI drug consumption	LNJP dispenses many OI drugs; however, actual consumption of OI drugs or profile of OI infection was not available. The proportion of clients that may have major OI was calculated based on the Ahmedabad client profile. The estimated consumption was calculated based on dosage and estimated clients who may have different OI infections.
Hospital volume patients	Departmental OP volume and total IP figures were made available from MRD for April 2004 to November 2005; projections were made till March 2006 using the "moving average forecasting" technique. IP to OP ratio was calculated for four sites viz. Ahmedabad, RML, Trichur, and Imphal. This ratio was then applied to departmental OP figure of LNJP to arrive at departmental IP figures.
Hospital volume laboratories	Similarly, precise laboratory volumes were not available. Laboratory-to-OP ratio was calculated for the above-mentioned four sites, and applied to LNJP figures to arrive at laboratory volumes.
ART clients volume laboratories	Following tests are done every six months: Haemogram, x-ray, liver function, kidney function.
CD4 test volume	Monthly data on CD4 testing, control, and failed tests available from microbiology lab till December 2005. Projections were made till March 2006 using "moving average forecasting" technique.

(continued)

Annex 6.2 Site-specific Details and Assumptions *(continued)*

Human resources (NACO)	An average time apportioned to LNJP was calculated based on the number of sites operating at the end of the year, i.e., 25 sites for 2004–05 and 54 for 2005–06.
Human resources (SACS)	Actual proportion of time of SACS staff was estimated based on discussions with relevant Delhi SACS staff. An average time per site was calculated based on the number of sites operating at the end of the year, i.e., two sites for 2004–05 and seven for 2005–06.
Human resources (ART clinic)	NACO-specified staff was in place by the end of the study period, but the calculation was done based on actual joining of the ART clinic. Hospital-sponsored staff includes two nurses, a nursing orderly, and a pharmacist.
Human resources (hospital staff)	Four physicians of different levels of seniority spent 10% of their time on the ART clinic. Since actual salaries of these staff were not available, average salary of RML physicians was taken as a proxy measure.
ARV drug expenditure	Delhi SACS has supplied Efaviranz 200 mg and also 67% of total Efaviranz 600 mg consumed during the study period.
OI drug expenditure	As the unit cost of OI drugs was not available, the cost from Tambaram hospital was used to arrive at estimated total expenditure on OI drugs.
Ram Manohar Lohia (RML) Hospital, New Delhi	
Prophylaxis—Septran (Co-trimoxazole) onsumption	CD4 count profile of ART clients was not available. Septran consumption was calculated based on the CD4 count profile of clients of Ahmedabad site. In RML until August 2005 the patients were given Septran for 30 days, and after August 2005 for 15 days.
OI drug consumption	Hospital does not supply any OI drugs and patients have to purchase their own.
Hospital volume patients	The patient load for calendar year 2004 and 2005 assumed to be same for study year April 2004 to March 2005 and April 2005 to March 2006, respectively.
Hospital volume laboratories	The patient load for calendar year 2004 and 2005 assumed to be same for study year April 2004 to March 2005 and April 2005 to March 2006, respectively.
ART clients volume laboratories	Haemogram is repeated every three months. Liver function test and x-ray are repeated every six months.
Human resources (NACO)	An average time apportioned to RML was calculated based on the number of sites operating at the end of the year, i.e., 25 sites for 2004–05 and 54 for 2005–06.
Human resources (SACS)	Actual proportion of time of SACS staff was estimated based on discussions with relevant DSCAS staff. An average time apportioned per site was calculated based on the number of sites operating at the end of the year, i.e., two sites for 2004-05 and seven for 2005-06.
Human resources (ART clinic)	NACO-sanctioned ART lab technician for CD4 machine was not filled till October 2004. Thus, hospital lab technician was taken into account for seven months. Two nurses are sponsored by hospital and have been working at the ART clinic during study period.

Annex 6.2 Site-specific Details and Assumptions *(continued)*

Human resources (hospital staff)	Five professors of the medicine department give 10% of their total time to ART clinic.
ARV drug expenditure	Delhi SACS has supplied Efaviranz 200 mg and 50% of total Efaviranz 600 mg consumed during the study period.
OI drug expenditure	No OI consumption.
Government Medical College and Hospital (GMC), Trivandrum, Kerala	
Prophylaxis—Septran (Co-trimoxazole) consumption	CD4 count profile of ART clients could not be made available. Septran consumption calculated based on the CD4 count profile of clients of Ahmedabad site for the period April 2005 to March 2006.
OI drug consumption	The profile of OI consumption is based on the estimates of Ahmedabad. Consumption of Doxycyclin tablets was calculated based on consumption pattern of RIMS.
Hospital volume patients	The patient load for calendar year 2005 used for the study period from April 2005 to March 2006.
Hospital volume laboratories	The patient load for the calendar year 2005 was used for the study period from April 2005 to March 2006 for all the laboratories. The total number of haemograms was used as proxy for the total tests at the pathology lab and number of liver function tests for the biochemistry lab. Since no compulsory tests were conducted at the microbiology lab, it was not taken into calculation for departmental support.
ART clients volume laboratories	Haemogram is repeated every three months, while liver function test and test for lipid profile are done every six months.
CD4 test volume	The only CD4 machine in the state of Kerala is placed at the skin department of the Trivandrum Medical College. The annual CD4 count figures for 2004 and 2005, and total during January to March 2006, were available. Monthly volume was not available and thus it was difficult to arrive at precise estimate of CD4 tests during the study period. During 2004, CD4 count was being done an average of 53 tests per month, which increased to 130 tests per month in 2005. This growth can be attributed to the ART program. Thus, it was assumed that during January to March 2005, CD4 tests were done at the average monthly rate of 53 tests and volume of April to December 2005 was calculated accordingly by subtracting 160 tests from the annual figure.
Human resources (NACO)	Trivandrum became a NACO site in May 2005, and the proportion of time NACO staff spent during 11 months of the study period was used in the study. However, since there was no drug supply from NACO during the study period, the procurement consultant's time was not taken into account.
Human resources (SACS)	Actual proportion of time of SACS staff was estimated based on discussions with relevant Dehli SCAS staff. An average time apportioned per site was calculated based on the number of sites operating at the end of the study period, i.e., five sites in Kerala.

(continued)

Annex 6.2 Site-specific Details and Assumptions *(continued)*

Human resources (ART)	From May 2005 (the beginning of the program) until November 2005, postgraduate students of the medical college were running the ART clinic on a rotation. NACO-sanctioned ART medical officer was in place from November 2005. The lab technician and recordkeeper were provided in January 2006. A dedicated laboratory technician was working on CD4 tests during April to November 2005. A SACS appointed counselor worked in the ART clinic from April 2005.
Human resources (hospital staff)	The head of the Department of Medicine spent about 50% of his time on the ART program. Two professors from the infectious diseases unit and medicine department respectively gave 15% and 1% of their time to ART clinic. An associate professor of dermatology who was in charge of CD4 testing gave about 25% of his time on ART program.
ARV drug expenditure	Started as a state-level initiative, drugs were procured by the Directorate of Medical Education purchased through the Central Purchase Committee of the state government. It became NACO-sponsored site in May 2005, but the drugs consumed during the study period were from the state-level procurement.
OI expenditure	The unit costs of relevant OI drugs were used from the rate list of the Central Purchase Committee of the government to calculate the total OI expenditure.
Hospital expenditure	The expenditure data for the period April 2005 to December 2005 was available, which was then extrapolated to get the data for the entire financial year. The actual expense on salaries for the college staff was not available. The proportion of budget provision for salaries to actual expenditure for Trichur was used for Trivandrum to estimate the expenditure for Trivandrum from its budget provision for 2005–06.
Government Medical College and Hospital (GMC), Thrissur, Kerala	
Septran (Co-trimoxazole) consumption	CD4 count profile of ART clients was not available. Septran consumption calculated based on the CD4 count profile of clients of Ahmedabad site for the period November 2004 to October 2005.
Hospital volume patients	The patient load for calendar year 2004 and 2005 was apportioned for the period from November 2004 to October 2005.
Hospital volume laboratories	The patient load for the period November 2004 to October 2005 was collected from the registers for all the labs. The number of haemograms was taken as proxy for the pathology lab and number of liver function tests was taken as proxy for the biochemistry lab.
ART clients volume laboratories	Following tests are done every six months: haemogram, x-ray, liver function.
CD4 test volume	CD4 machine is not available at Trichur. ART patients either go to Trivandrum or private labs for CD4 testing.
Human resources (NACO)	Trichur was not a NACO-sponsored site during the study period, so NACO staff time was not taken into account.

Annex 6.2 Site-specific Details and Assumptions *(continued)*

Human resources (SACS)	Actual proportion of time of SACS staff was estimated based on discussions with relevant Kerala SACS staff. An average time apportioned per site was calculated based on the number of sites operating at the end of the study period, i.e., five sites in Kerala.
Human resources (ART clinic)	A SACS appointed medical officer and a counselor were in place at the ART clinic during the study period.
Human resources (hospital staff)	Two faculty members, from the departments of dermatology and neurology, give 36% and 10% of their time to the ART clinic, respectively.
ARV drug expenditure	Being a state-level initiative, drugs were procured by the Directorate of Medical Education purchased through the Central Purchase Committee of the state government.
CD4 kits/reagents expenditure	Not applicable.
OI drug expenditure	The unit costs of relevant OI drugs were used from the rate list of the Central Purchase Committee of the government to calculate the total OI expenditure.
Hospital expenditure	Expenditure statements of the Directorate of Medical Education and Directorate of Health Services accounts were available for the financial year 2005–06. The salary figures for 2005–06 for the hospital is based on the revised estimate of fiscal year 2004–05. Additionally, Hospital Development Committee (HDC) expenses were also taken into account.

Source: Authors.

Annex 6.3 List of Compulsory Tests

Site	*Pathology*	*Biochemistry*	*Microbiology*	*Radiology*
Tambaram	Haemogram	Liver function test, urea, creatinin, blood sugar		X-ray
Imphal	Haemogram	Liver function test, lipid profile, kidney function test	Hepatitis B Hepatitis C	X-ray Ultrasound
Ahmedabad	Haemogram	Liver function test, lipid profile, kidney function test	Hepatitis B Hepatitis C	X-ray Ultrasound
LNJP, New Delhi	Haemogram Urine	Liver function test, lipid profile, kidney function test	VDRI, Hepatitis B Hepatitis C	X-ray Ultrasound
RML, New Delhi	Haemogram Urine	Liver function test, lipid profile	VDRI, Hepatitis B Hepatitis C	X-ray
Trivandrum	Haemogram	Liver function test, lipid profile		
Trichur	Haemogram	Liver function test		X-ray

Annex 6.4 Time Allocation of NACO Staff to ART Clinic Program in Selected Hospitals

	Joint Director (ART & Surveillance)		*ART Consultant*		*Director (CD4)*		*Procurement Consultant*	
Site	*Time allocated (Percent)*	*Duration in months*	*Time allocated (Percent)*	*Duration in months*	*Time allocated (Percent)*	*Duration in months*	*Time allocated (Percent)*	*Duration in months*
GHTM	0.73	24	2.93	15	0.29	24	1.17	24
RIMS	1.00	16	4.00	7	0.40	16	1.60	16
BJMC	0.46	12	1.85	12	0.19	12	0.74	12
LNJP	0.73	24	2.93	15	0.29	24	1.17	24
RML	0.73	24	2.93	15	0.29	24	1.17	24
TVM	0.46	11	1.85	11	0.19	11		

Annex 6.5 Time Allocation of SACS Staff to Selected ART Clinic Programs

Staff	*Time allocated (Percent)*	*Staff*	*Time allocated (Percent)*
GHTM, Tambaram		*BJMC, Ahmedabad*	
ART consultant	15	Monitoring and evaluation officer	5
Finance controller	2		
Project director	6	Project director	1
Deputy director	10	Store officer	25
Senior technical officer - Deputy director	6	T.C.O	5
		RML and LNJP	
Finance officer	5	Accountant	3.93
RIMS, Imphal		D (C&S)	20
Project director	5	APD	3.57
Store officer	5	Procurement officer	3.57
APD	10	*TVM and Thrissur*	
Deputy director	10	Accountant	0.2
Finance controller	2.5	Administrative assistant	2
Finance officer	2.5	APD	0.2
		Deputy director	2
		Project director	0.2

Source: Authors' calculations.

Notes

1. NACO is the government nodal agency in charge of formulating, coordinating, and implementing policies and response on HIV and AIDS in India, including through state-level agencies called State AIDS Prevention and Control Societies (SACS).
2. Answer of the Minister of State in the Health Ministry to Lok Sabha: Unstarred question no. 454 has been answered on 27th July 2005.

3. These numbers pertain to the situation existing a year ago. Currently, as per NACO figures for May 2007, there are about 80,000 individuals in the country on ART. In all, there are currently 117 NACO-supported ART sites all over the country, with 68 of these being in high-prevalence states with GFATM-supported programs catering to some three-fourths of the total clients on ART.
4. We do not include the large outpatient departments of the general hospitals, as the ART patient loads were a very small part of the total OPD load.
5. One potential pitfall with this approach occurs when a substantial share of costs relates to overhead, and average costs would therefore decline strongly with the number of people receiving treatment (i.e., there are economies of scale). As the bulk of costs, presented below, can be attributed to the costs of treatment, rather than overhead, we do not differentiate between treatment costs and overhead in this exercise.
6. Tambaram hospital is mainly a TB hospital, catering to a large number of HIV-positive patients. Therefore, the number of physicians involved in the ART program is much higher.
7. For the Kerala sites, the Directorate of Medical Education, Department of Health and Family Welfare, purchased the drugs. Even now, after these sites have become NACO sites, the drugs are not being supplied by NACO.
8. This consists of one physician, one surgeon, one gynecologist, one pediatrician, one community medicine specialist, one microbiologist, one psychiatrist, one TB specialist, one STD specialist, and one staff nurse.
9. The distribution across drug regimens was not available from Trivandrum.
10. Thrissur has been left out of this because it did not have a CD4 machine, and including it would have yielded inaccurate shares.
11. This is lower than the share of ARV in the Thai national program, which was estimated at 60 percent (Supakankunti et al. 2003).
12. BJMC, Ahmedabad, may be an outlier because it purchased a large quantity of drugs on its own.
13. Data over two years were also available for Tambaram; as it is a specialty hospital, it is not included in this table.
14. Since Trivandrum and Thrissur were initially state programs, the respective cost shares are not comparable with the other sites; the two sites are therefore reported, but excluded from the analysis of cost shares. Tambaram (as a specialty hospital) is also not used for calculating averages across NACO sites.
15. The distribution of the sample was as follows: Chennai (45), RIMS (28), LNJP (45), RML (41), Ahmedabad (45), Trivandrum (26), and Thrissur (34). The samples have been taken keeping in view the client load across sites. Since the respondents had to be interviewed at the ART clinic, the sampling

was purposive, but the interviews were spread over several days (although there did not seem to be any particular pattern to the type of individuals attending the clinic on any particular day).

16. The question on food was worded carefully, and the interviewers were also trained to ask the question so that routine food intakes were not included. The emphasis was on whether the client has been advised by anyone to eat additional nutritious food like eggs, meat, milk, and fruits.
17. A survey of recent publications on this issue is maintained by the UN Standing Committee on Nutrition, and is available online (as of June 2007) at http://www.unsystem.org/scn/Publications/AnnualMeeting/hiv_reference/SCN_HIV_articles/ARV_and_nutrition_interactions.htm.

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Index

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